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MAKING COMPLEX EASY

DUBLIN PORT COMPANY

DUMPING AT SEA PERMIT APPLICATION S0024-02

FORESHORE LICENCE APPLICATION FS006893

MP2 Project - Revised Appropriate Assessment Screening and Natura Impact Statement (NIS)
March 2022

MP2 Project, Dublin Port
Habitats Directive Appraisals

Revised AA Screening & NIS

Final, Rev B
March 2022

Note:

The additional information in this document has been prepared in March 2022 in response to requests for additional information from the Office of Environmental Sustainability of the EPA in relation to Dumping at Sea permit application S0024-02, and also from the Foreshore Section of the Department of Housing, Local Government & Heritage, for the MP2 Project report to inform screening for appropriate assessment and Natura Impact Statement (NIS) to be updated to take into account:

- Additional relevant plans or projects in the in-combination assessment given that the MP2 project will span 15 years from 2020–2035 (at revised sections 4.4 and 4.4.1, and new sections 4.4.24 and 4.4.25);

- The cumulative effects of dumping at sea activities as supported by a detailed modelling assessment of the predicted deposition of silts within Dublin Bay from dumping activities, cumulatively across the MP2 Project, the Dublin Port 2022-2029 Maintenance Dredging Programme and the Dublin Harbour Capital Dredging Project Dumping at Sea Permit applications (at new section 4.4.25 and addition of new cumulative deposition modelling report at Appendix 4);

- Additional information previously submitted to An Bord Pleanála in relation to use of the ESB/Irish Water outflow weir at the base of the Great South Wall by the waterbirds of South Dublin Bay and River Tolka Estuary SPA (at revised sections 5.5.1.3.3, 5.5.1.4 and new Appendix 6);

- Clarification on the proposed dates of dredging for the various aspects of the MP2 project (at revised sections 3.2, 3.2.1. 3.2.7; and 3.3.2);

- Inclusion of a request by the applicant to increase both the permitted volumes and loading areas in the vicinity of the proposed riverside Berths 52 & 53 in the assessment of the impact of the proposed changes to the permit application on the relevant Natura 2000 sites (at revised sections 4.3.2.2, 4.3.2.3, 4.3.3, 5.2.1.3, 5.3.1.1.3.1 and 5.4.1.1.3.1).

Signposts to changes in the main body of text to this revised NIS are noted in blue text under each respective Section heading.

Deletions are shown by ~~strikethrough text~~ where applicable to make the document consistent with the additional information.

Those portions of the original July 2019 NIS where text revisions have not occurred have not been reproduced in order to highlight only those aspects of the revised NIS which have been updated in response to the requests for additional information from the EPA and the Department.

Approval for issue

22.03.2022

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1 INTRODUCTION

Text for Section 1 remains unchanged.

2 METHODOLOGY

Text for Section 2 remains unchanged.

3 THE PROPOSED DEVELOPMENT

- Section 3.1 remains unchanged.
- New text added at introduction to Section 3.2 to introduce the requested increase both to the permitted Volume and Loading Area in the vicinity of the proposed riverside Berths 52 & 53.
- Additional figure added to Section 3.2.
- Text of subsections 3.2.1 – 3.2.6 remain unchanged.
- New text added to subsection 3.2.7.
- Revised table of dredge volumes added to subsection 3.2.7.
- New text and tables added to Section 3.3.2 to describe the current MP2 Project programme.
- Sections 3.3.3 – 3.6 remain unchanged.

3.2 PROPOSED DEVELOPMENT WORKS

This section of the NIS describes both the proposed marine and landside structural works, and the associated dredging and infill works required to achieve the MP2 Project's objectives. A site plan of the ~~proposed~~ works as originally proposed is presented in Figure 3-3, and Figure 3-4 shows the additional loading areas sought as a supplement under Dumping at Sea Permit application S0024-02. DPC require a supplement to this application to increase both the permitted Volume and Loading Area in the vicinity of the proposed riverside Berths 52 & 53. This change is required to advance the construction of Berth 52, Berth 53 and the Unified Ferry Terminal ahead of programme in order to meet the post Brexit priority demands of national port infrastructure, and is discussed further in Section 3.3.2. Additional dredge volumes are listed in Table 3-1.

The MP2 Project application area is delineated by a red line and the marine and landside works individually identified. The works proposed as part of the MP2 Project are summarised as follows:

- Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length on an alignment north of the Port's fairway and south and parallel to the boundary of the South Dublin Bay & River Tolka SPA (004024).
- A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034). Berth 52 is also designed to accommodate ferries up to 240m in length. The works will also comprise an amendment to the consented open dolphin structure (ABP Ref. 29N.PA0034) to create a closed berthing face at the eastern end of Berth 49.

  [Elsewhere within the ABR Project, the extension of the existing Berth 49 is already consented to also make this berth capable of accommodating ferries up to 240m in length. The combination of the ABR Project with the MP2 Project will therefore deliver three river berths all capable of accommodating ferries up to 240m in length].

- A lengthening of an existing river berth (50A) to provide the Container Freight Terminal with additional capacity to handle larger container ships. These works will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. These works will also include dredging to a standard depth of -11.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- As part of the infilling of Oil Berth 4, it is proposed to redevelop Oil Berth 3 as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to decarbonise the economy.
- The dredging of a berthing pocket to a standard depth of -13.0m CD at Oil Berth 3 will require stabilisation of the existing quay wall at Jetty Road. It is not proposed to use this quay wall for the berthing of vessels.
- Dredging at the proposed Berth 53 and channel widening to a standard depth of -10.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT). Works include reorganisation of access roads; two proposed check in areas comprising a total of 14 check lanes; proposed set down and parking area for the existing Terminal 1 building; proposed pedestrian underpass to access the existing Terminal 1 building; three proposed toilet blocks and a proposed ESB Substation. These works will comprise amendments to consented developments with planning reference numbers 3084/16 & 3638/18, and the ABR Project (ABP Ref. 29N.PA0034).
- A heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area. This will comprise an alteration to consented development planning reference 3084/16.

3.2.1 Construction Design Considerations

Section 3.2.1 remains unchanged

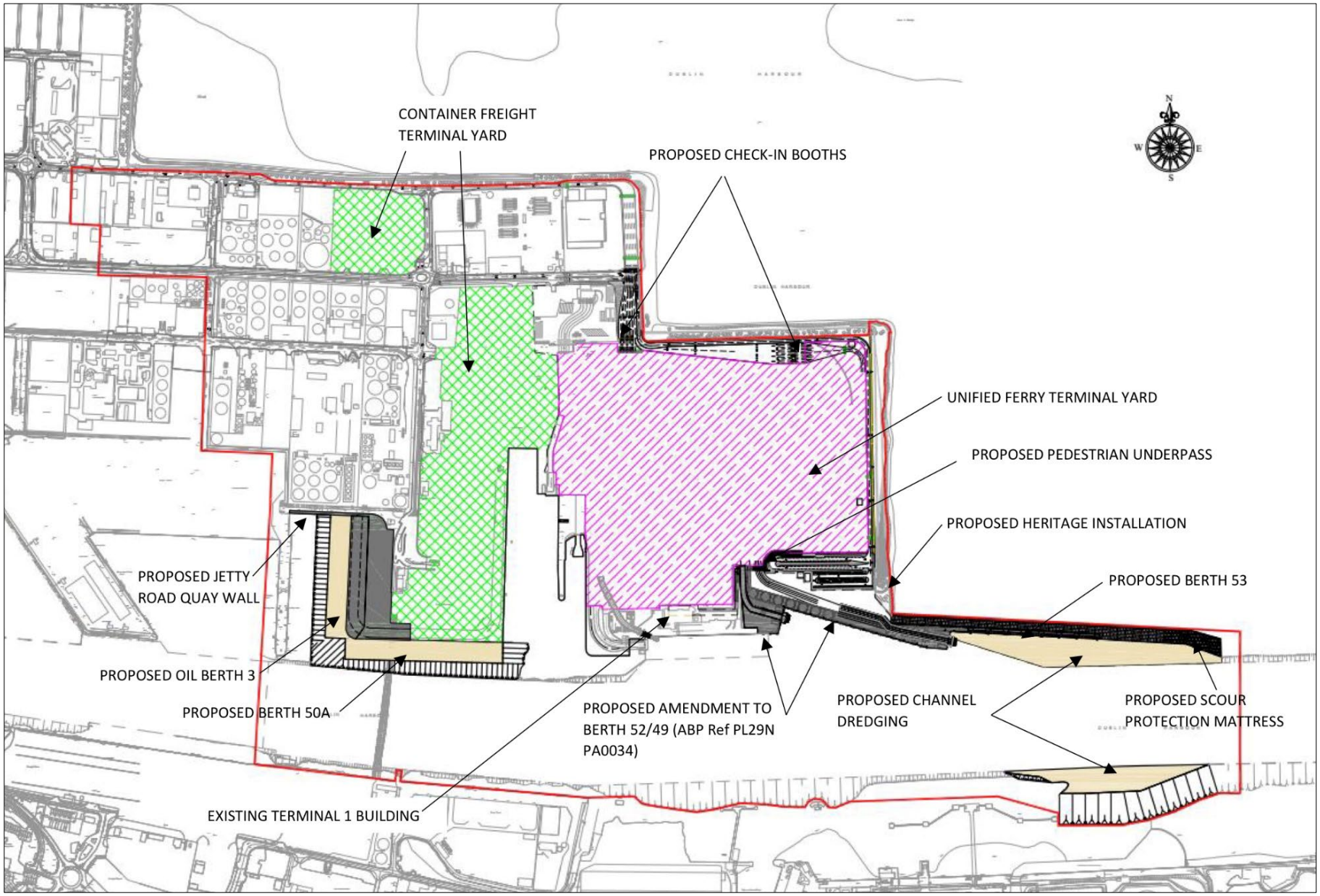


Figure 3-1 Site plan of the proposed works

Figure 3-2 Showing additional MP2 Loading Areas

3.2.5 Dredging & Disposal Works

The revised volume of capital dredging required for each element of the works, as described in the previous sections, is tabulated in Table 3-1.

Table 3-1 Dredging Summary

Element of Work	Reference within Section 3 '*Proposed Development*'	Standard depth	Volume
Berth 53	Section 3.2.3	-10.0m CD	~~159,595m³~~ 403,268m³
Channel Widening	Section 3.2.6	-10.0m CD	111,995m³
Oil Berth 3	Section 3.2.5	-13.0m CD	83,414m³
Berth 50A	Section 3.2.4	-11.0m CD	69,640m³
Total Volume to be dredged			**~~424,644m³~~** **668,317m³**

The capital dredging works will be carried out using a trailing suction hopper dredger and/or a backhoe dredger. Other ancillary equipment will include a survey vessel and bed-leveller to remove peaks and troughs created by the dredger.

It is proposed to dispose of the dredged material at the licenced dump site at the entrance to Dublin Bay located to the west of the Burford Bank, presented in Figure 3-15.

The loading and dumping of the dredged material will be subject to separate consents; a Foreshore Licence is required from the Department of Housing, ~~Planning and~~ Local Government and Heritage (~~DHPLG~~DHLGH) and a Dumping at Sea Permit is required from the Environmental Protection Agency (EPA).

3.3 CONSTRUCTION PHASE

3.3.1 Construction Elements

Section 3.3.1 remains unchanged.

3.3.2 Construction Sequence Summary

The following construction sequence summary has been separated into two elements: land phases and marine phases. The proposed project phasing plan is presented in Figure 3-24. The original sequencing programme is presented in Figure 3-25. The original key milestone dates for delivery of the MP2 Project within DPC's overall Masterplan development programme at the time of the initial application is shown in Table 3-2.

Table 3-2 Original MP2 Project Construction Programme (July 2019)

Item	Works	Start	Finish	Duration
1	Berth 52	Q2 2022	Q4 2024	30 months
2	Berth 53	Q1 2025	Q4 2026	24 months
2a	B52/ B53 Landside works	Q2 2022	Q3 2028	76 months
3	Oil Berth 3 and infill of Oil Berth 4	Q3 2028	Q1 2031	32 months
4	Berth 50A	Q1 2031	Q2 2032	20 Months

DPC has updated the MP2 Project programme from that envisaged at the time of the application. The programme changes are required to advance the construction of Berth 52, Berth 53 and the Unified Ferry Terminal ahead of the original programme in order to meet the post Brexit priority demands of national port infrastructure.

It is now DPC's intention to deliver the MP2 Project in two main phases:

- Construction of Berth 52, Berth 53, the Unified Ferry Terminal and Channel Widening commencing in either Q1 2022 or Q3 2022 depending on the timing of the grant of a Foreshore Licence and Dumping at Sea Permit; and
- Construction of Oil Berth 3, infill of Oil Berth 4 and Berth 50A commencing in Q3 2028.

The updated MP2 Project programme from that envisaged at the time of the application originally being made is described below and presented in Table 3-3.

Table 3-3 Current MP2 Project Construction Programme (September 2021)

Item	Works	Start	Finish	Duration
1	Berth 52	Q1 2022 or Q3 2022	Q4 2027	63 months
1a	Channel Widening	Q1 2022 or Q3 2022	Q1 2024	24 months
2	Berth 53	Q1 2022 or Q3 2022	Q3 2025	36 months
2a	B52/ B53 Landside works	Q3 2022	Q4 2029	87 months
3	Oil Berth 3 and infill of Oil Berth 4	Q3 2028	Q1 2031	30 months
4	Berth 50A	Q1 2031	Q2 2032	18 Months

Sections 3.3.3 – 3.6 remain unchanged.

4 SCREENING FOR APPROPRIATE ASSESSMENT

- Sections 4.1 and 4.2 remain unchanged
- Text revised in sections 4.3.2.2.1, 4.3.2.2.2, 4.3.2.3.3 and 4.3.3 to reflect the requested increase both the permitted Volume and Loading Area
- New text in introduction to Section 4.4, and amended text in section 4.4.1
- New subsections 4.4.24 and 4.4.25 added to introduce additional in-combination projects, and new Figures 4.7 and 4.8.
- Sections 4.5 and 4.6 remain unchanged

4.3.2.2 Rockabill to Dalkey Island SAC

4.3.2.2.1 Reefs

The proposed disposal site (refer to Figure 4.2) is located within Rockabill to Dalkey Island SAC. It is proposed to dispose of ~~424,644~~668,317m^3 of dredge material (refer Table 3-1) at the proposed disposal site over a series of winter seasons between ~~2024~~ 2022 and ~~2031~~ 2032, periodically levelling the seabed to remove peaks and troughs created by the disposed material:

- Berth 52, Berth 53 and the channel widening (Winter ~~2026~~ 2021-2027)
- Oil Berth 3 is dredged (Winter ~~2030~~ 2028-2031)
- Berth 50A (Winter 2031)

In addition to possible effects of underwater noise on harbour porpoise (and which is dealt with in Section 4.3.3), disposing of this quantum of seabed material within a European site must be considered with respect to the possible implications for the qualifying interest habitat of that European site.

Rockabill to Dalkey Island SAC is an enormous site (in excess of 27,000ha) but the Annex I reef habitat for which it is designated accounts for less than 1% of the site and occurs at a number of locations throughout the European site. The seabed at the disposal site is not in itself a location of Annex I reef habitat and is not a location of a qualifying interest of the European site.

The intertidal reef community complex is recorded on the south coast of Howth, where the exposure regime of the complex ranges from exposed to moderately exposed reef. Exposed reef is also recorded on the east side of Dalkey Island, on the east and southern shores of Ireland's Eye and on all shores of Rockabill and the Muglins. Moderately exposed reef occurs on the western shores of Dalkey and at Howth and Ireland's Eye. The subtidal reef community complex is recorded off the islands within the site and also off the coast between Lambay Island and Rush Village. The exposure regime here ranges from moderately exposed reef at the Muglins to exposed reef over the remainder of the site. The coastlines of Howth Head, Dalkey Island and Ireland's Eye are 3.3km, 5.1km and 7.5km respectively from the proposed disposal site. Lambay Island is 16km north of the proposed disposal site and Rockabill is approximately 30km to the north.

The closest qualifying reef habitat is located 3.3km north of the proposed disposal site and 5km from the MP2 Project in Dublin Port. The issue is whether or not elevated concentrations of suspended sediments or pollutants could result in likely significant effects on the qualifying reef habitat.

Conservation targets for 'Habitat Area' and' Distribution' of reef habitat are met when the permanent area (or distribution as the case may be) is stable or increasing, subject to natural processes. The Rockabill to Dalkey Island SAC Conservation objectives supporting document for Marine Habitats and Species (NPWS, 2013) notes that:

- the 'permanent area' target refer to activities or operations that propose to permanently remove reef habitat, thus reducing the permanent amount of reef habitat; and
- the 'distribution' target refer to activities or operations that propose to permanently remove reef habitat, thus reducing the range over which this habitat occurs.

These targets for do not refer to long or short term disturbance of the biology of reef habitats. Therefore, these conservation targets will not be undermined by any potential water quality or habitat deterioration effects of the proposed development.

However, there is a possibility that the community structure target to conserve the Intertidal and Subtidal reef community complexes in a natural condition may be affected by plumes arising from the disposal of dredged material or polluting events if the activities resulted in elevated concentrations of suspended sediments or pollutants in or at the reef community complexes for prolonged periods. NPWS (2013) notes that this target relates to the structure and function of the reef and therefore it is of relevance to those activities that may cause disturbance to the ecology of the habitat.

Despite the significant capacity of Dublin Bay to dilute elevated concentrations of suspended sediments and polluting substances, construction phase and operational phase risks remain in the absence of any further evaluation and analysis and the likely application of measures intended to avoid or reduce the harmful effects of the proposed development on the qualifying Reef habitat of Rockabill to Dalkey Island SAC. Accordingly, the possibility of likely significant effects cannot be excluded.

4.3.2.2.2 Harbour porpoise

Turning then to the harbour porpoise, the COs for this Annex II species is to maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC, as defined by 2 no SSCO attributes and targets:

Access to suitable habitat: Species range within the site should not be restricted by artificial barriers to site use

Disturbance: Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site

The targets for the SSCO attribute 'Access to suitable habitat' is measured in 'number of artificial barriers'. The target for 'Disturbance' is measured in 'Level of impact'. In relation to potential water

quality and habitat deterioration effects, the degree to which the water in the SAC is turbid and influence prey availability for the porpoise population does not appear to relate to any of the conservation targets listed above. NPWS (2013) notes however that harbour porpoise is an aquatic predator that feeds on a wide variety of fish, cephalopod and crustacean species occurring in the water column or close to the seabed, with dive depths in excess of 200m having been recorded for the species. Foraging areas for harbour porpoise are often associated with areas of strong tidal current and associated eddies; and the occurrence of porpoises close to shore or adjacent to islands and prominent headlands is commonly reported. NPWS (2013) also notes that the conservation target for disturbance relates *inter* alia to proposed activities or operations that may result in the deterioration of key resources (e.g. water quality, feeding, etc) upon which harbour porpoises depend, and in the absence of complete knowledge on the ecological requirements of the species in this site, such considerations should be assessed where appropriate on a case-by-case basis.

With that in mind, the disturbance target that "*human activities should occur at levels that do not adversely affect the harbour porpoise community at the site*" could be affected by plumes arising from the disposal of dredged material at the proposed disposal site within the SAC if the activity resulted in a reduction in prey availability. The question is whether or not a reduction in prey availability would likely be significant if it were to occur temporarily and only in a small part of the SAC.

Given that disposal of dredge material would occur in ~~four~~ a series of consecutive winters over a ~~eight~~ ten year period as described in Table 3-1 and in Section 4.3.2.2.1 above, that elevated concentrations of suspended sediments would decrease in the water column around the disposal site over time and across the normal tidal cycle as sediments disperse and dilute to background levels, and the fact that harbour porpoise prey is mobile rather than static like the Annex I reef habitat, the possibility can be excluded that a decrease in prey availability would occur as a result of the disposal plume at and in the environs of the disposal site to such an extent as to conflict with the conservation target for disturbance at a community level for harbour porpoise in the SAC.

The risk of suspended sediments escaping into the marine environment as a result of disposal of dredged material providing a hydrological pathway of effect leading to a deterioration of key resources upon which the harbour porpoise community depends within Rockabill to Dalkey Island SAC can be ruled out. Likely significant effects can be excluded.

There are other potential sources of pollution of the marine environment that may arise as a result of the construction and operation of the MP2 Project, as discussed in Section 4.3.2.1.1.2. Significant mixing of seawater occurs in Dublin Bay with freshwater flowing in from the Liffey, Tolka and Dodder. The mixing of any polluting materials that escape to the marine environment as a result of the construction or operation of landside elements of the MP2 Project is further aided by the tidal currents, wind and wave climate which transport the mix of seawater and freshwater (and any polluting substances) both into and out of the Liffey Estuary, and help it disperse throughout Dublin Bay.

The capacity of the Liffey and Tolka Estuaries and Dublin Bay to dilute any elevated concentrations of polluting substances that escape into the marine environment is very significant, and the fact that Rockabill to Dalkey Island SAC is at least 6.5km from the MP2 Project landside elements excludes the possibility of likely significant effects of polluting substances escaping into the marine environment providing a hydrological pathway of effect leading to a deterioration of key resources upon which the harbour porpoise community depends within Rockabill to Dalkey Island SAC. Likely significant effects can be excluded.

4.3.2.3 Lambay Island cSAC

4.3.2.3.3 Grey Seal and Harbour Seal

Turning then to the two Annex II species (Grey Seal and Harbour Seal) that Lambay Island cSAC is designated for, the COs for these species are to maintain the favourable conservation condition of Harbour Seal (or Grey Seal as the case may be) in Lambay Island cSAC, as defined by 5 no SSCO attributes and targets:

Access to suitable habitat: Species range within the site should not be restricted by artificial barriers to site use

Breeding behaviour: The breeding sites should be maintained in a natural condition

Moulting behaviour: The moult haul-out sites should be maintained in a natural condition

Resting behaviour: The resting haul-out sites should be maintained in a natural condition

Disturbance: Human activities should occur at levels that do not adversely affect the harbour seal (or grey seal) population at the site

The targets for the SSCO attribute 'Access to suitable habitat' is measured in 'number of artificial barriers'. The target for 'Breeding behaviour' is measured in 'breeding sites'. The target for 'Moulting behaviour' is measured in 'moult haul-out sites'. The target for 'Resting behaviour' is measured in 'resting haul-out sites'. The target for 'Disturbance' is measured in 'Level of impact'.

Like the harbour porpoises of Rockabill to Dalkey Island SAC, Grey seal and Harbour seal are also successful aquatic predators that feeds on a wide variety of fish and cephalopods (with crustaceans also forming an import part of the diet of Harbour seals).

NPWS (2013) notes that the conservation target for disturbance relates *inter* alia to proposed activities or operations that may result in the deterioration of key resources (e.g. water quality, feeding, etc) upon which harbour seal (or grey seal as the case may be) depend, and in the absence of complete knowledge on the ecological requirements of the species in this site, such considerations should be assessed where appropriate on a case-by-case basis.

It must be recalled that Lambay Island cSAC is more than 15km by sea from the disposal site and more than 20km by sea from Dublin Port. The question in this case is whether or not a reduction in prey availability more than 15km away at the disposal site (but within the feeding range of the seals) would likely be significant if it were to occur.

Noting the narrative in Section 4.3.2.2.2 above, in relation to potential prey reduction of harbour porpoise within Rockabill to Dalkey Island SAC that disposal of dredge material would occur in ~~four~~ a series of consecutive winters over a ~~eight~~ ten year period, elevated concentrations of suspended sediments would decrease in the water column around the disposal site over time and across the normal tidal cycle as sediments disperse and dilute to background levels, and the fact that seal prey is mobile rather than static like the Annex I reef habitat; a decrease in prey availability would not occur as a result of the disposal plume at and in the environs of the disposal site to such an extent as to conflict with the conservation target for disturbance at a harbour or grey seal population level in the cSAC.

The risk of suspended sediments or pollutants escaping into the marine environment as a result of disposal of dredged material providing a hydrological pathway of effect leading to a deterioration of key resources upon which the harbour or grey seal populations depend within Lambay Island cSAC can be ruled out in the absence of further evaluation and analysis or the application of measures intended to avoid or reduce the harmful effects of the proposed development on the site. LSEs can be excluded.

4.3.3 Underwater Noise and Disturbance

As described in Section 3, some aspects of the MP2 Project will require activities in the marine environment and new marine infrastructure to be constructed and operated. Marine engineering construction includes many activities producing underwater noise, including:

- Ground investigation works to assess the nature of the bedrock and overburden materials including cable percussion boring, rotary coring, and penetration testing
- Demolition of buildings and maritime infrastructure close to the Liffey channel
- Marine piling
- Dredging of ~~424,644~~668,317m^3 of sediment to achieve desired depths in the various berths and channel widening
- Dispose of the dredged material at the proposed disposal site
- Increased vessel traffic following construction and operation of new port facilities

These activities carry an inherent risk of noise induced effects upon some marine species as a result of underwater acoustic energy being released into the marine environment. The purpose of the screening assessment is to determine whether or not the possibility of likely significant effects arising from such noise sources can be excluded.

Underwater noise is not a persistent effect, and once the noise source ceases noise levels drop very quickly to pre-existing levels. The natural underwater soundscape of Dublin Port and Dublin Bay is not

silent - biological sounds from fish and marine mammals are mixed with sounds from waves and surface noise; current flow and turbulence; rain and wind/storm noise; and noise from shipping and leisure craft activities. The ambient noise levels in coastal and inshore water, bays and harbours are subject to huge variation.

Lambay Island cSAC is designated for its populations of harbour and grey seals. Rockabill to Dalkey Island SAC is designated for its harbour porpoise community. No other European site within 20km of Dublin Bay or its surrounds is designated for a species of marine mammal. Having said this, Bull Island (less than 2km from the proposed dredging areas) is a known seal haul out site and grey seals occur here and also at Lambay Island (16km from the disposal site) and Ireland's Eye (7.6km from the disposal site) which are known breeding sites. Harbour seals also haul out at Bull Island, Lambay Island and Ireland's Eye.

There is a potential for exposure to underwater noise at construction stage to affect the Rockabill to Dalkey Island SAC harbour porpoise community through disturbance during dredging at the berths and channel widening works, and disposal of dredged material at the proposed disposal site.

There is a potential for exposure to underwater noise at construction stage to affect the Lambay Island cSAC (including Bull Island and Ireland's Eye) seal populations through physical injury or disturbance by demolition and piling operations within Dublin Port and disturbance during dredging at the berths and channel widening works, and disposal of dredged material at the proposed disposal site.

There is also the potential for exposure to underwater noise at construction stage to affect the distribution and abundance of preferred prey species of the harbour porpoise community, and grey and harbour seal populations.

Finally, there is also the potential for persistent exposure to increased levels of underwater noise at operational stage to result in disturbance of the harbour porpoise community and grey and harbour seal populations.

As these risks clearly exist, then it follows that the risk of underwater acoustic energy escaping into the marine environment to provide a pathway of effect leading to physical injury or disturbance to the harbour porpoise community and grey and harbour seal populations remains in the absence of further evaluation and analysis and the consideration of application of measures intended to avoid or reduce the harmful effects of the proposed development on Rockabill to Dalkey Island SAC and Lambay Island cSAC. LSEs cannot be excluded at this stage.

4.4 IN-COMBINATION EFFECTS

Article 6(3) of the Habitats Directive and Irish national law require that in-combination effects with other plans or projects are considered. The significance of any identified combined effects of the proposed development and other past, present or reasonably foreseeable future plans or projects must also be evaluated. On this basis, a range of other projects were considered in terms of their potential to have

in-combination effects with the MP2 Project. Those plans and projects are illustrated in Figures 4.5 and 4.6 and include:

Other Projects within the MP2 Project Area (Figure 4.5)

- Alexandra Basin Redevelopment (ABR) – ABP Reg. Ref. PL29N.PA0034
- Extension Terminal 2 Check-In Area – Reg. Ref. 2299/12
- Vehicular and Pedestrian Entrances off Breakwater Road South – Reg. Ref. 2596/15
- Dublin Port Internal Road Network – Reg. Ref. 3084/16 and 2684/17.
- Demolition of Buildings and Provision of Yard – Reg. Ref. 2429/17
- Floating Dock Section Reg. Ref. 4216/17
- Vehicle Service/Maintenance Facility and Office Accommodation – Reg. Ref. 3143/18
- Asahi Demolition and Provision of Yard – Reg. Ref. 3488/18
- Demolition of Calor Offices and Provision of Yard – Reg. Ref. 3540/18
- Interim Unified Passenger Terminal – Reg. Ref. 3638/18
- Alexandra Road, Dublin Port, Dublin 1 (Reg. Ref. 4521/18)
- Dublin Ferry port Terminal Access – Reg. Ref. 3314/18
- Berth 49 Ramp. Reg. Ref 2756/19
- DPC Post 2019/2021 Maintenance Dredging Campaign (Subject to Dumping at Sea Licence)

Other Projects surrounding the MP2 Project Area (Figure 4.6)

- Dublin Inland Port - Reg Ref. F18A/0139 (not on figure)
- North Lotts & Grand Canal Dock Planning Scheme 2014- BP Ref. PL29N.ZD2011
- Exo Building – Reg. Ref. DSDZ3632/15, DSDZ3686/16, DSDZ3776/17
- Poolbeg West SDZ. BP Ref. PL29N.ZD2013
- Irish Water – Ringsend WwTP –Upgrade Project BP Ref. PL29S.301798
- Howth Yacht Club Marina Extension (not on figure)

A search of other plans and projects which have been advanced since the NIS was originally submitted, with potential to have in-combination effects with the MP2 Project, has been made in order to update the in-combination appraisal set out below. The search of other plans and projects has identified the following two projects:

- Dublin Port 2022 – 2029 Maintenance Dredging Programme (Dumping at Sea application submitted to the EPA on 25th February 2021 (Ref S0004-03), not yet determined.

- Dublin Harbour Capital Dredging Project (Dumping at Sea application submitted to the EPA on 26th August 2021 (Ref S0033-01), not yet determined.

Each of these projects were themselves accompanied by a NIS which took into account the potential for in-combination effects with the MP2 Project.

4.4.1 Alexandra Basin Redevelopment (ABR) Project

DPC was granted planning permission subject to conditions (ABP Reg. Ref. PL29N.PA0034) in July 2015 for the redevelopment of Alexandra Basin, Berths 52 and 53 and dredging of the channel of the River Liffey together with associated works in Dublin Port. Elements of the proposed development can be summarised as follows:

Alexandra Basin West:

- The infilling of graving Dock No. 2 having an area of 6,055sq.m;
- The excavation and restoration of historic Graving Dock No. 1
- The demolition of the bulk jetty having an area of 3,200sq.m;
- A section of North Wall Quay extension having an area of 21,700sq.m;
- Extension of Alexandra Quay West of 130m in length;
- New 273 m long Ro-Ro jetty and provision of three Ro-Ro ramps; and
- The dredging of: 470,000sq.m of contaminated material to a depth of -10.0m Chart Datum (CD) over an area of 194,000sq.m within the redeveloped Alexandra Basin and its remediation.

Berth 52 and 53:

- The demolition of existing berths 52 and 53;
- Jetty at Berth 52 having an area of 500sq.m;
- Concrete Dolphin at Berth 53 having an area of 500sq.m;
- The construction of:
    - A new river berth at Berths 52/53, 300m long;
    - A new 75m mooring jetty at the new river berth.
    - New 40 m long mooring jetty to extend existing berth 49, 50m long;
    - The infilling of the Terminal 5 Ro-Ro basin, an area of 45,650sq.m;
    - Raising of existing levels by 1.4 m over an area of 95,000sq.m; and
    - Dredging of new river berth to -10.0m CD.

Liffey Channel:

- Construction of a marina protection structure to a height of +7.0m CD and a length of 220m on the south side of the river channel; and

- Dredging of the shipping channel to a depth of -10m CD from a point 55m to the east of the East link bridge, to a location in the vicinity of Dublin Bay, a total distance of 10,320m.

The ABR Project is now being implemented by DPC. The AA Screening Report/NIS prepared for ABR Project 'screened in' likely significant effects upon North Dublin Bay cSAC; South Dublin Bay cSAC; Rockabill to Dalkey Island SAC; North Bull Island SPA; and South Dublin Bay & Tolka Estuary SPA.

Measures intended to avoid or reduce the harmful effects of the proposed development on the sites concerned were proposed and conditioned to the permission. Adverse effects upon the integrity of all sites assessed will not occur as a result.

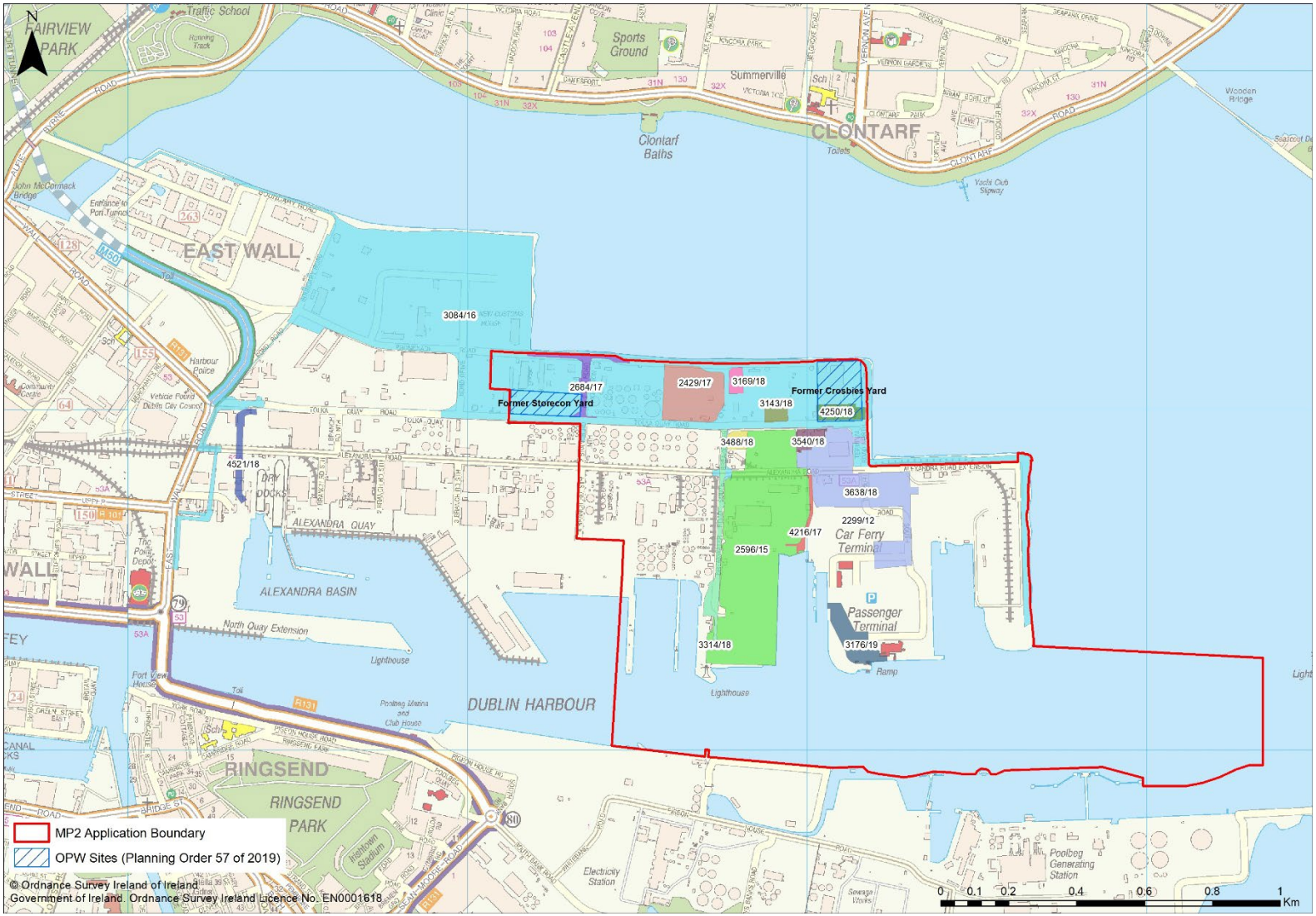


Figure 4.1 Other Projects within the MP2 Project Area

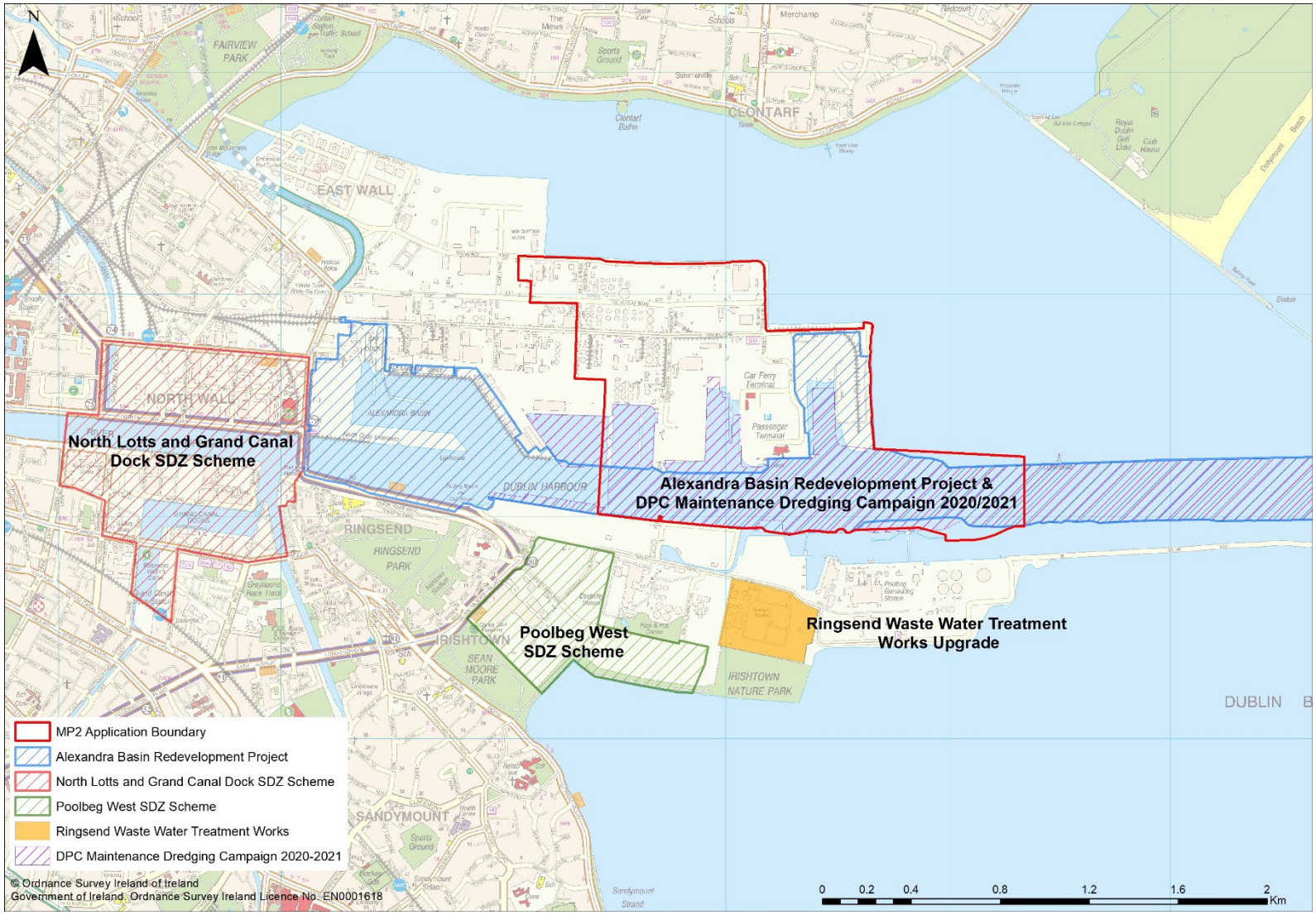


Figure 4.2 Other Projects surrounding the MP2 Project Area

The principal pathways of cumulative effect that might occur with the construction of the MP2 Project in combination with the ABR Project are water quality and habitat deterioration, underwater noise and aerial noise and visual disturbance.

The dredging and disposal of material at sea for MP2 Project is proposed to occur sequentially after that for the ABR Project, and not concurrently. As such, the modelled rates of dredging and disposal will not be exceeded at any given time, and the modelled extent of dredge or disposal plumes, their predicted concentrations of suspended sediments and predicted rates of sedimentation at proximate shorelines remain valid when these activities are considered in combination or cumulatively. Therefore the possibility of significant adverse impacts either cumulatively or in combination with the ABR project can be excluded beyond scientific doubt.

When the timing of dredging and disposal for MP2 Project and its associated vessel movements and underwater sound produced are considered in combination with the ABR Project, the result is that the same magnitudes of underwater noise are predicted, but they will occur for ~~six~~ four consecutive winter seasons associated with ABR Project alone, followed by a further ~~four~~ sequence of winter seasons, between ~~2024~~ 2022 and ~~2031~~ 2032 for MP2 Project. The temporal scale of these effects is increased from ~~six~~ four events in ~~six~~ five years to ~~ten~~ fifteen events in ~~thirteen~~ sixteen years. The magnitude of effect remains the same for each event. Cumulatively, when the mitigation measures implemented as part of the ABR Dredging Management Plan and Marine Mammal Management Plan are taken into consideration, the effect dredging and disposal activities will have on the harbour porpoise community of Rockabill to Dalkey Island SAC and the seal populations of Lambay Island cSAC both within the cSAC and at known haul out sites of Ireland's Eye and Bull Island, is predicted to remain the same in combination as it is as a result of the MP2 Project alone. Given the measures to be applied to the ABR activities which are intended to avoid or reduce this effect on the marine mammals, the extended temporal duration is not significant. Therefore the possibility of significant adverse impacts either cumulatively or in combination with the ABR project can be excluded beyond scientific doubt.

When aerial noise and visual disturbance effects are considered in combination, it is to be recalled that the ABR Project NIS assessment considered that the only feature species of the South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA that was likely to be affected by the ABR Project was Light-bellied brent goose as it fed on the quays of Alexandra Quay West. Dredging and disposal were activities to be carried out over winter when the breeding tern population was not present, no significant effects will occur. The ABR Project was sufficiently spatially separated from the intertidal areas of the River Tolka estuary that no significant effects will occur upon the wintering wading and waterbird populations that use it. The MP2 Project will not result in any effects upon this species when both projects are considered together. Therefore the possibility of significant adverse impacts either cumulatively or in combination with the ABR project can be excluded beyond scientific doubt.

4.4.24 Dublin Port 2022 – 2029 Maintenance Dredging Programme

Dublin Port Company (DPC) need to carry out regular maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their advertised charted depths and hence provide safe navigation for vessels to and from the Port.

The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1: uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea was made through a programme of sediment chemistry sampling and analysis and eco-toxicological testing. It is proposed to dispose of the dredged sediments at the existing licenced offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, 6.75 km from the lighthouse at the end of the Great South Wall.

The maximum amount of material to be dredged is 300,000 m^3 per annum and it consists mostly of silt and sand with elements of clay, gravel and cobbles. Dredging will be carried out by a trailer suction hopper dredger and support vessels. It is proposed to undertake the maintenance dredging and disposal at sea operations within the period April to September each year between 2022 and 2029. An additional closed period will operate within the inner Liffey channel upstream of Berth 49, including the main channel and channel side berths but not including the basins between 1st April and 14th May to protect migrating Atlantic salmon smolts and River lamprey. The dredging campaign within each of these periods is expected to last approximately 4-6 weeks, depending on weather conditions.

These works have been subject to appraisal under the Habitats Directive. Subject to the implementation of mitigation measures in respect of the proposed maintenance dredging and associated dumping it is not envisaged that the maintenance dredging programme alone will give rise to any adverse impacts upon the integrity of any European site. Furthermore, maintenance dredging will take place in the summer months only, while the proposed MP2 Project capital dredging will take place within the winter months only, therefore avoiding the potential for additive in-combination effects. There is limited potential for cumulative effects through increased suspended sediments and which could lead to deterioration of water quality and wetland habitats across the year. It has been conclusively demonstrated however in previous analyses that effects of turbidity and increased suspended sediments does not remain in the water column for more than a short period of time as tidal cycles and currents disperse sediments to background levels quickly.

When the timing of dredging and dumping for the proposed MP2 Project capital dredging and its associated vessel movements and underwater sound produced, is considered in combination with the Maintenance Dredging Programme, the result is that the same magnitudes of underwater noise are predicted, but they will continue to occur across the year in combination (i.e. in all months) rather than during the winter period only, as will occur with the proposed MP2 Project capital dredging alone. The temporal scale of these effects is increased.

The magnitude of effect that the dredging and dumping activities will have on the harbour porpoise community of Rockabill to Dalkey Island SAC and the seal populations of Lambay Island SAC both within the SAC and at known haul out sites of Ireland's Eye and Bull Island, is predicted to remain the same in combination as it is as a result of the proposed MP2 Project capital dredging alone. Given the measures to be applied to the maintenance dredging activities which are intended to avoid or reduce this effect on the marine mammals, and the minimal impacts predicted to arise as a result of the proposed works, the extended temporal duration is not significant. No additional effects occur cumulatively or in combination in this regard beyond scientific doubt.

Likely significant cumulative or in-combination effects of the proposed MP2 Project capital dredging and the Dublin Port maintenance dredging programme 2022-2029 can be excluded beyond scientific doubt.

4.4.25 Dublin Harbour Capital Dredging Project

The Dublin Harbour Capital Dredging Project brings forward for consent key elements of the capital dredging works required to create the required depth of the navigation channel, basins and berthing pockets as set out in the Dublin Port Masterplan 2040, reviewed 2018. The works proposed in the Dublin Harbour Capital Dredging Project are shown in Figure 4.7 and comprise a number of elements:

- Deepening the navigation channel between North Wall Quay Extension and the Western Oil Jetty, including riverside Berth 35;
- Deepening of Alexandra Basin East and deepening/widening of berths;
- Deepening of the Oil Basin and widening of berths;
- Deepening of the Ferryport Basin;
- Deepening of riverside Berth 52;
- Widening the South Port (Berths 42 - 47) berths, and
- Removal of ridge between the navigation channel and the Poolbeg Oil Jetty (Berth 48).

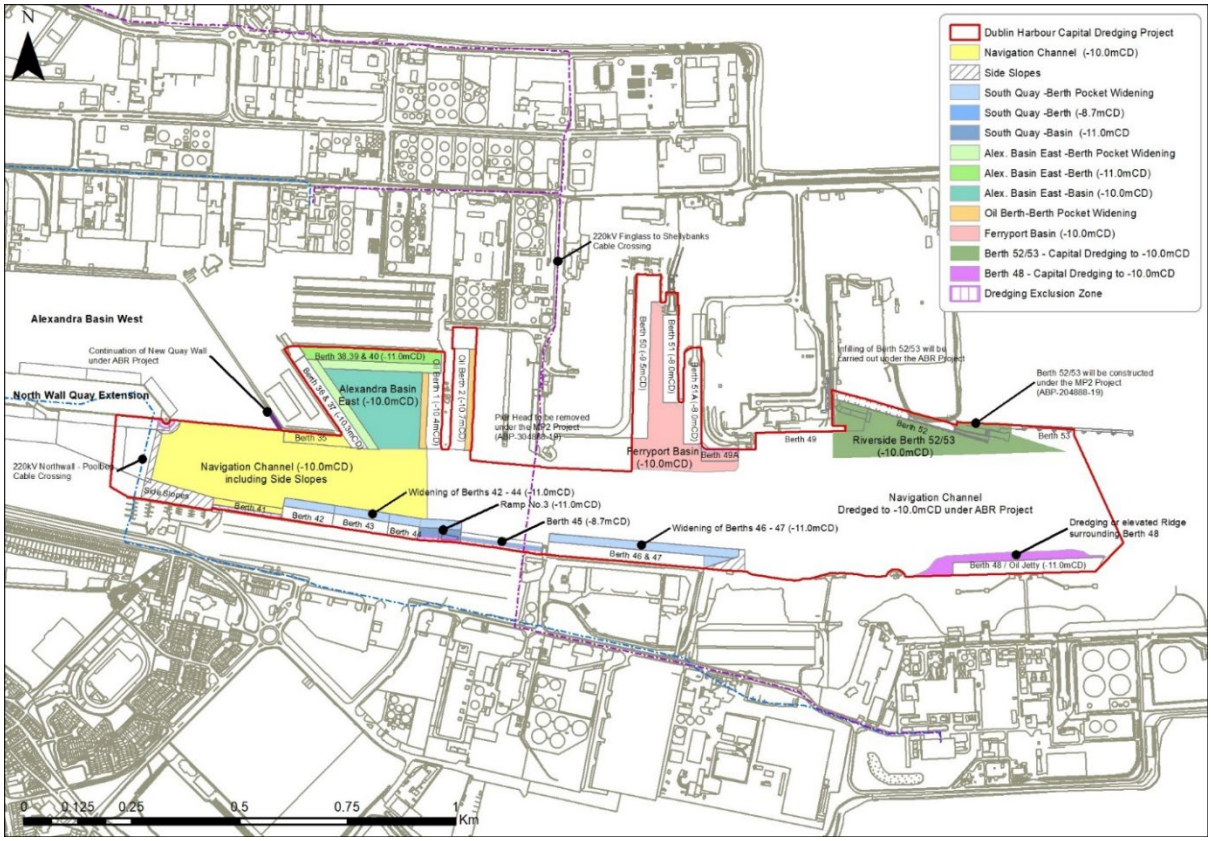


Figure 4.3 Main elements of the Dublin Harbour Capital Dredging Project

The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1: uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea was made through a programme of sediment chemistry sampling and analysis and eco-toxicological testing. It is proposed to dispose of the dredged sediments at the existing licenced offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, 6.75 km from the lighthouse at the end of the Great South Wall.

The total estimated dredge volume is estimated to be 500,000 m^3 and includes a siltation tolerance/ contingency to account for material which has settled in Dublin Harbour in the period between successive maintenance dredging campaigns and the commencement of the capital dredging campaign (Table 4-2).

The material to be dredged comprises clays, silts, sands and gravels with occasional cobbles. No dredging of rock is required.

Table 4-1 Dublin Harbour Capital Dredging Project -Capital Dredging Volumes

Dredge Zone	Estimated Dredge Volume above design (m^3)
Zone 1 – Navigation Channel	121,008
Zone 2 – South Port Berths	26,146
Zone 3 – Alexandra Basin East	47,020
Zone 4 – Oil Basin	7,842
Zone 5 – Ferryport Basin	27,970
Zone 6 – Riverside Berth 52	127,515
Zone 7 –Poolbeg Oil Jetty (Berth 48)	11,296
Dredge Volume (m^3)	368,797 m^3
Siltation / Tolerance / Contingency (m^3)	131,203 m^3
Total Dredge Volume (m^3)	**500,000 m^3**

The proposed capital dredging works will be restricted to the winter period (October – March) over an eight year period (October 2022 – March 2030). The AA Screening Report and NIS prepared for Dublin Harbour Capital Dredging Project screened in likely significant water quality effects upon North Dublin Bay cSAC; South Dublin Bay cSAC; Rockabill to Dalkey Island SAC; North Bull Island SPA; and South Dublin Bay & Tolka Estuary SPA. The appraisal also screened in likely significant disturbance effects upon North Bull Island SPA; and South Dublin Bay & Tolka Estuary SPA. Measures intended to avoid or reduce the harmful effects of the proposed development on the sites concerned were proposed. Adverse effects upon the integrity of all sites assessed were not predicted to occur as a result.

Capital Dredging under the Dublin Harbour Capital Dredging Project is anticipated to commence in 2022 (subject to the grant of a Foreshore Licence and Dumping at Sea Permit). The capital dredging associated with the Dublin Harbour Capital Dredging Project will occur over the same winter periods as the capital dredging required under the MP2 Project. However, the capital dredging for the two projects will be undertaken sequentially, that is, only one dredger will operate at any given time. The modelled rates of dredging and dumping will therefore not be exceeded at any given time, and the modelled extent of dredge or dumping plumes, their predicted concentrations of suspended sediments and predicted rates of sedimentation at proximate shorelines remain valid when these activities are considered in combination.

To validate this hypothesis, a cumulative deposition modelling run was undertaken in March 2022, to examine the predicted cumulative deposition of silts within Dublin Bay arising from proposed Dumping at Sea Activities under MP2 Project (EPA DaS application S0024-02), the Dublin Port 2022-2029 Maintenance Dredging Programme (EPA DaS application S0004-03) and the Dublin Harbour Capital Dredging Project (EPA DaS application S0033-01). Appendix 4 of the NIS now contains this additional

cumulative deposition modelling report. The programme of dumping at sea activities for all three projects is shown in Figure 4.8.

The cumulative deposition modelling (at Appendix 4) shows that the coarser fraction of the silt, i.e., the sand fraction that had a mean grain size of 200µm was found to behave differently relative to the two finer fractions that had mean grain diameters of 20µm and 3µm in that it remained almost exclusively within the immediate vicinity of the licenced dump site. Conversely, the two finer silt fractions were carried away by the tidal currents towards the expanse of the Irish Sea.

The predicted total deposition of the silt fractions of the total dredge material disposed under S0024-02, S0004-03 and S0033-01 is presented in Figure 7 to Figure 9 respectively, in the cumulative deposition modelling report. As demonstrated by these Figures, the maximum total deposition of silt material within Dublin Bay does generally not exceed 0.40g/m^2.

The cumulative sediment deposition within Dublin Bay as a result of all three dumping at sea activities (DaS applications S0024-02, S0004-03 and S0033-01) is presented in Figure 10 of the cumulative deposition modelling report at Appendix 4. As demonstrated by this Figure, the cumulative total deposition of silt material is generally less than 0.55g/m^2.

This magnitude of deposition translates to a maximum change in bed level thickness of c. 0.40µm as illustrated in Figure 11. This is less than the width of a human hair and is not measurable in the field.

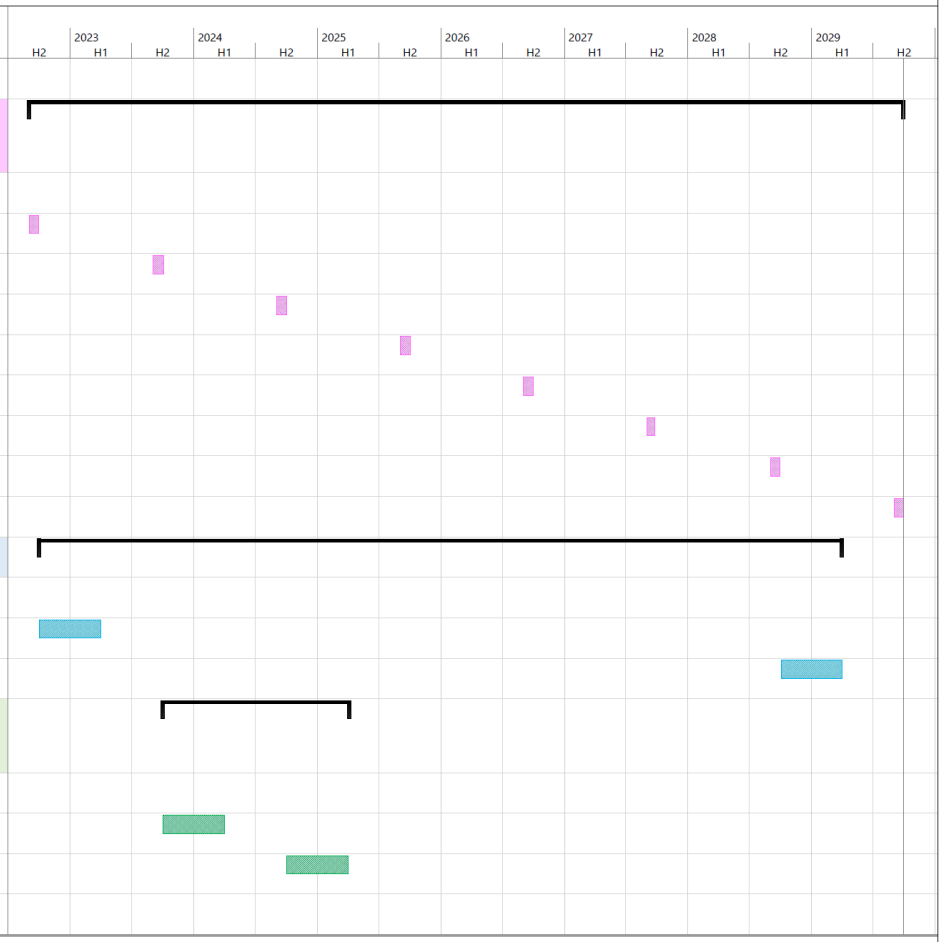
As such, no additional effects occur cumulatively or in combination in this regard beyond scientific doubt.

Therefore, the possibility of significant water quality or disturbance effects of the proposed capital dredging associated with MP2 Project either cumulatively or in combination with the Dublin Harbour Capital Dredging Project and Dublin Port Maintenance Dredging Programme can be excluded beyond scientific doubt.

COMHLACHT CHALAFORT ÁTHA CLIATH
DUBLIN PORT COMPANY

Indicative Dredging Schedule

ID	Task Name	Maximum Volume (m3)	Start	Finish
1				
2	***S0004-03 (Maintenance Dregding)***	***2400000***	***01/09/2022***	28/09/2029
3	**Season**			
4	1	300000	01/09/2022	28/09/2022
5	2	300000	01/09/2023	02/10/2023
6	3	300000	01/09/2024	30/09/2024
7	4	300000	01/09/2025	30/09/2025
8	5	300000	01/09/2026	30/09/2026
9	6	300000	01/09/2027	24/09/2027
10	7	300000	01/09/2028	28/09/2028
11	8	300000	01/09/2029	28/09/2029
12	***S0024-02 (MP2 Capital Dredging***	***668316***	***01/10/2022***	31/03/2029
13	**Element of Work**			
14	Berth 52 & Channel Widenin	515262	01/10/2022	31/03/2023
15	Oil Berth 3 & Berth 50A	153054	02/10/2028	31/03/2029
16	***S0033-01 (Capital Dredging Project)***	***500000***	***02/10/2023***	***04/04/2025***
17	**Season**			
18	1 (inclusive of contingency)	250000	01/10/2023	31/03/2024
19	2 (inclusive of contingency)	250000	01/10/2024	31/03/2025
20				



Date: 14/03/2022

Summary S0004-03 S0024-02 S0033-01

Page 1

Figure 4.8: Indicative dumping at sea programme for S0024-02, S0004-03 and S0033-01

5 APPROPRIATE ASSESSMENT

- Section 5.1 remains unchanged
- New text added to Section 5.2.1.3, 5.3.1.1.3.1, and 5.4.1.1.3.1
- New subsection 5.5.1.3.3
- New text added to section 5.5.1.4
- Section 5.6 - 5.7 remains unchanged

5.2 ROCKABILL TO DALKEY ISLAND SAC

5.2.1 Underwater Noise and Disturbance effects

5.2.1.3 Assessment of Conservation Objectives

In relation to the conservation targets set for harbour porpoise in its conservation objectives, NPWS (2013) advises that in relation to Target 1 '*Species range within the site is not restricted by artificial barriers to site use'*, the target is relevant to proposed activities or operations that will result in the permanent exclusion of harbour porpoise from part of its range within the site, or will permanently prevent access for the species to suitable habitat within the site, and does not refer to short-term or temporary restriction of access or range.

In relation to Target 2 '*Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site'*, the target is relevant to proposed activities or operations that introduce man-made energy at levels that could result in a significant negative impact on individuals and/or the community of harbour porpoise within the site. This refers to the aquatic habitats used by the species in addition to important natural behaviours during the species annual cycle.

These conservation targets are measured by things that do or do not occur within Rockabill to Dalkey Island SAC. Recall that Rockabill to Dalkey Island SAC is 5km from the MP2 Project but the sea disposal site is located within the European site. As disposal of dredged material at sea occurs within the SAC, it could possibly result in the permanent exclusion of harbour porpoise from part of its range within the site, or will permanently prevent access for the species to suitable habitat within the site. The disposal at sea activity is proposed over a series of winter seasons between ~~2024~~ 2021 and ~~2031~~ 2032, periodically levelling the seabed to remove peaks and troughs created by the disposed material:

- Berth 52, Berth 53 and the channel widening (Winter ~~2026~~ 2021-2027)
- Oil Berth 3 is dredged (Winter ~~2030~~ 2028-2031)
- Berth 50A (Winter 2031)

This is a short-term activity to occur ~~four~~ a number of times across a ~~eight~~ ten year period. NPWS (2013) advises that the conservation target does not apply to short-term or temporary restrictions of access or range. As such, there is no aspect of the MP2 Project that could permanently exclude harbour porpoise from part of its range within Rockabill to Dalkey Island SAC. There is no aspect of the MP2 Project that could: permanent exclusion of harbour porpoise from part of its range within Rockabill to Dalkey Island SAC, or will permanently prevent access for the species to suitable habitat within Rockabill to Dalkey Island SAC.

Target 1 and the first part of Target 2 cannot be offended as a result of the potential effects of MP2 Project and in that regard the project will not adversely affect the integrity of the sites and no reasonable scientific doubt remains as to the absence of such effects.

However, Target 2 also relates to proposed activities or operations that may result in the deterioration of key resources (e.g. water quality, feeding, etc) upon which harbour porpoise depend, and proposed activities or operations that could cause death or injury to individuals to an extent that may ultimately affect the harbour porpoise community of Rockabill to Dalkey Island SAC (NPWS, 2013).

5.3 NORTH DUBLIN BAY CSAC

5.3.1.1.3.1 Dredging

As noted above in Section 5.2.2.1.3, MIKE 21/3 hydrodynamic numerical modelling was used in conjunction with hydrographic survey data including bathymetric survey of Dublin Port and the Tolka estuary area and a comprehensive sediment survey of the Tolka estuary, and site specific water quality monitoring data to address potential coastal processes issues including the dispersion and settlement of sediment plumes generated during dredging operations in Dublin Port. Modelling outputs and an assessment of the effects of dredging as a result of the construction of the MP2 Project is included at Appendix 4 of the NIS.

Three individual simulations were run to simulate the dredging operations at Berth 53, the channel widening area south of the channel, and at Oil Berth 3 and Berth 50A. Each simulation was run for one month to represent the full dredging operation in each area. Model input parameters are described in Table 5.5. The output from these simulations is presented in the following Sections of this Report.

Table 5.1 Dredging simulation input parameters

Parameter	Value
Trailer Suction Hopper Dredger capacity	4,100 m^3
Ratio of sediment/entrained water during loading	0.3
Average density of material inside hopper	1.65 t/m^3
Average Trip Frequency between Dublin Port and Disposal site	3.0 hours
Average Time to Fill Dredger Hopper	1.5 hours
Time to release load	90 seconds
Overspill Trailer Suction Hopper Dredger head	0%

Sediment loss at Trailer Suction Hopper Dredger head	1% of silts

In line with the Dredging Management Plan developed for the ABR Project, no over-spill from the dredger's hopper was included in any of the three model simulations.

5.3.1.1.3.1.1 Dredging of Berth 53

The dispersion of silts during dredging is illustrated by a series of plume diagrams that show the suspended sediment concentration of silt in the water column resulting from the dredging operations. Figure 5.10 to Figure 5.13 represent the dispersion of silt material at times of low water, mid flood, high water and mid ebb at a time during the simulated dredging campaign when the suspended sediment concentrations may be expected to be at their highest values (i.e. when the dredger is active at the site).

These figures show that the suspended sediment concentration plumes are confined to the northern half of the navigation channel at all times. The sediment concentrations of the plumes are generally less than 25 mg/l beyond the immediate dredge area. The lateral extent of the 10mg/l plume envelope is generally less than 750m under most tidal conditions.

Monitoring of the Liffey and Tolka Estuaries between East Link Bridge and the entrance to the Port at Poolbeg Lighthouse has been undertaken by the ABR Project. Measurements of turbidity at the North Bank Light (adjacent to the Tolka Estuary) over the period 2017 – 2018 have ranged from 0 to 39.5 NTU with a mean of 2.6 NTU (n=17,533). This equates to a suspended solids range of 0 to 98 mg/l with a mean of 6.4 mg/l. While there is a relatively small and very local predicted increase in suspended solids due to dredging at Berth 53, this falls within the background range measured close to this location during normal Port operations.

The predicted deposition of the silt fractions lost to the water column during the dredging of Berth 53 at the end of a simulated one-month dredging campaign is presented in Figure 5.14. This Figure shows that the volume of material deposited outside of the dredge area is generally less than 0.40g/m^2 and that the deposition of sediment is generally confined to within the immediate area of the dredging operation. It should be noted that dredging proceeds until the specified design depth is reached and any material deposited within the dredge area will be removed by the dredger until the specification is met.

Whilst Figures 5.10 to 5.14 showing plots of dispersion of finer silt materials and deposition of silt fractions do not include simulations of the additional loading areas illustrated in Figure 3-4, it is important to note that:

(i) the dredge material in these additional loading areas is of the same composition and characteristics of the sediment modelled in simulations described above in Table 5.4 and in Appendix 4 of the NIS; and

(ii) the modelled rates of dredging and dumping will not be exceeded at any given time, and the modelled extent of dredge or dumping plumes, their predicted concentrations of suspended

sediments and predicted rates of sedimentation at proximate shorelines remain valid when dredging in the additional loading areas is taken into account.

5.4 SOUTH DUBLIN BAY CSAC

5.4.1 Water Quality and Habitat Deterioration effects

5.4.1.1 Mudflats and sandflats not covered by seawater at low tide

5.4.1.1.1 Conservation Objectives

5.4.1.1.2 Potential Significant Effects

5.4.1.1.3 Assessment of Effects

5.4.1.1.3.1 Dredging

As noted above in Sections 5.2.2 and 5.3.1, coastal process modelling was used in conjunction with hydrographic and sediment surveys to predict the dispersion and settlement of sediment plumes generated during dredging activities in Dublin Port. Modelling outputs and an assessment of the effects of dredging as a result of the construction of the MP2 Project is included at Appendix 4 of the NIS.

As set out in Section 5.3.1.1.3.1 above in relation to potential significant water quality and habitat deterioration effects of dredging on North Dublin Bay cSAC, dredging activities at Berth 53, the channel widening area south of the channel, at Oil Berth 3 and Berth 50A were simulated for one month to represent the full dredging operation in each area.

Plume diagrams of the dispersion of silts during dredging of Berth 53 showing the suspended sediment concentration of silt in the water column are illustrated in Figures 10-13 of Appendix 4 of the NIS. The predicted deposition of silt fractions lost to the water column during the dredging of Berth 53 at the end of a simulated one-month dredging campaign is illustrated in Figure 14 of Appendix 4.

These figures show that the suspended sediment concentration plumes are confined to the northern half of the navigation channel at all times and are generally less than 25 mg/l beyond the immediate dredge area. The lateral extent of the 10mg/l plume envelope is generally less than 750m under most tidal conditions. The volume of material deposited outside of the dredge area is generally less than 0.40g/m^2 and the deposition of sediment is generally confined to within the immediate area of dredging.

Plume diagrams of the dispersion of silts during Channel Dredging Works showing the suspended sediment concentration of silt in the water column are illustrated in Figures 15-18 of Appendix 4 of the NIS. The predicted deposition of silt fractions lost to the water column during Channel Dredging Works at the end of a simulated one-month dredging campaign is illustrated in Figure 19 of Appendix 4.

These figures show that the suspended sediment concentration plumes are confined to the southern half of the navigation channel and are generally less than 25 mg/l beyond the immediate dredge area. The lateral extent of the 10mg/l plume envelope is generally less than 600m under most tidal conditions. The volume of material deposited outside of the dredge area is generally less than 0.30g/m2 and the deposition of sediment is generally confined to within the immediate area of dredging.

Plume diagrams of the dispersion of silts during dredging of Oil Berth 3 and Berth 50A showing the suspended sediment concentration of silt in the water column are illustrated in Figures 21-23 of Appendix 4 of the NIS. The predicted deposition of silt fractions lost to the water column during dredging of Oil Berth 3 and Berth 50A at the end of a simulated one-month dredging campaign is illustrated in Figure 24 of Appendix 4.

These figures show that the suspended sediment concentration plumes are confined to within Oil Berth 3 and the northern half of the navigation channel and are generally less than 35 mg/l beyond the immediate source point. While there is a relatively small and very local predicted increase in suspended solids due to dredging at Oil Berth 3 and Berth 50A, this is well within the background range experienced at these locations during normal Port operations. The volume of material deposited outside of the dredge area is generally less than 8g/m^2 and the deposition of sediment is generally confined to within the immediate area of dredging.

As noted above in Section 5.3.1.1.3.1.1, whilst Figures 5.10 to 5.14 showing plots of dispersion of finer silt materials and deposition of silt fractions do not include simulations of the additional loading areas illustrated in Figure 3-4, it is important to note that:

(i) the dredge material in these additional loading areas is of the same composition and characteristics of the sediment modelled in simulations described above in Table 5.4 and in Appendix 4 of the NIS; and

(ii) the modelled rates of dredging and dumping will not be exceeded at any given time, and the modelled extent of dredge or dumping plumes, their predicted concentrations of suspended sediments and predicted rates of sedimentation at proximate shorelines remain valid when dredging in the additional loading areas is taken into account.

It can, therefore, be concluded that dredging activities at Berth 53, the channel widening area south of the channel, at Oil Berth 3 and Berth 50A will not result in any significant impact to water quality in the Lower Liffey channel and Tolka estuary. Plumes do not extent as far as South Dublin Bay cSAC under any modelled wave and tidal scenario.

The coastal processes assessment at Appendix 4 provides scientific certainty that the risk of suspended sediments escaping into the wider marine environment beyond the dredge area at Berth 53, Oil Berth 3, Berth 50A or in the channel will not imperil the conservation objectives set for the principal benthic communities of the Annex I Mudflats and sandflats not covered by seawater at low tide habitat within South Dublin Bay cSAC.

Dredging of Berth 53, Oil Berth 3, Berth 50A or Channel Widening will not adversely affect the integrity of North Dublin Bay cSAC and no reasonable scientific doubt remains as to the absence of such effects.

5.5 SOUTH DUBLIN BAY & RIVER TOLKA ESTUARY SPA

5.5.1 Aerial Noise and Visual Disturbance effects

5.5.1.3 Surveys conducted to inform the Assessment

5.5.1.3.1 Non-breeding waterbird surveys

5.5.1.3.2 Breeding tern surveys

5.5.1.3.3 Dredging disturbance surveys

A series of dredging disturbance bird surveys were undertaken at the ESB Power Station cooling water outfall adjacent to Poolbeg Tank Farm and the Great South Wall over six days between 22-27 October 2019. Appendix 6 to this NIS contains the bird survey report.

The purpose of these surveys was to record any disturbance events relevant to SPA Special Conservation Interest species as observed by the ornithologist before, during and after capital dredging works associated with the ABR Project being carried out under Dumping at Sea Permit S0024-01 in the navigation channel over a period of six days. Twenty four hours of observations were made over the six survey dates.

5.5.1.4 Assessment of Effects

Insert new text at end of following section on p256:

Non-breeding waterbirds use the site north of the proposed Berth 53 in several different ways. This depends largely on the time of year and tidal level, although factors such as weather conditions and disturbance are undoubtedly important. At normal barometric pressure there will be on average only 40 occasions per year. At some low spring tides, when some intertidal sediment is exposed for short periods, flocks of waders and gulls select this area for feeding (Plate 5.2 and Plate 5.3). The visits by waterbird flocks are generally short and infrequent due to the limited period of exposure (usually a maximum of 1-2 hours per day). Most of the extreme low tide periods in winter months occur in darkness or poor light. Waterbirds do not use the site at other parts of the tidal cycle (median or high tides) or on other dates when spring tides do not occur. ~~There are no non-breeding waterbird high tide roosts on or close to the site.~~

On the opposite side of the river, there is an area used both as a low tide feeding area and high tide roost outside of the SPA, at the ESB Power Station cooling water outfall adjacent to Poolbeg Tank Farm I at the base of the Great South Wall in the Liffey channel. This area is not a coded Dublin Bay IWeBS count sub-site but is included in the survey areas for the Dublin Bay Birds Project and holds regular numbers of Black-headed Gulls, and smaller numbers of Sanderling, Black-tailed Godwits and Redshank.

The distance from this area to the nearest point where shipping would turn is 172m. There are circa 48 existing shipping movements per day (24 arrivals and 24 departures, see EIAR Appendix 13.1) including throughout the overwintering season at similar distances past this location and, likewise, there are

existing shipping movements at a similar or smaller distance to this from the existing SPA boundaries on the north side of the Liffey channel.

No negative effects of disturbance to waterbirds as a result of these existing shipping movements has been observed to date. In addition, shipping is not generally perceived to be a threat to non-breeding waterbirds and that they will quickly habituate to it. Black-headed Gulls in particular are highly habituated to human activity and will regularly forage in areas where people walk on the intertidal area or on coastal grassland. This species is one of the most habituated, adaptable and opportunistic SCI species of South Dublin Bay and River Tolka Estuary SPA. The type of vessels involved in dredging are slow-moving, and would not represent any greater threat to waterbirds than other commercial shipping movements.

Nonetheless, to assist the competent authority in conducting an appropriate assessment an additional bird survey was undertaken at the ESB Power Station cooling water outfall adjacent to Poolbeg Tank Farm and the Great South Wall over six days between 22-27 October 2019. Appendix 6 to this NIS contains the bird survey report.

Twenty four hours of observations were made over the six days. Dredging occurred 200m from the area of interest at the base of the Great South Wall on four of the six survey days. In summary, 18 disturbance events out of 100 potential events resulted in behavioural change of the birds present:

- Eleven events, all caused by small wakes produced by passing ships, resulted in behavioural change (e.g. vigilance or alarm call) but not flight;
- Five events, all caused by potentially predatory birds flying over, resulted in some of the birds present taking flight, but they soon returned to the site; and
- Two events, both caused by wakes produced by the Dublin Port pilot vessel passing at speed, resulted in some of the birds present taking flight and not returning.

No disturbance whatsoever was observed to occur as a result of the dredging activities. There is no potential for disturbance from dredging activities to cause impacts on the SPA Special Conservation Interest species. Dredging of the navigation channel in front of the cooling water outfall at the Great South Wall is not an *ex-situ* factor that could potentially impact upon the attainment of Objective 1 for the overwintering Special Conservation Interest species of South Dublin Bay and River Tolka Estuary SPA.

There will be no appreciable decrease in the range, timing or intensity of use of this area by any SPA Special Conservation Interest species as a result of dredging activities associated with the proposed MP2 Project. Accordingly, there will not be any adverse effect on the integrity of the South Dublin Bay and River Tolka Estuary SPA.

6 CONCLUSION OF THE HABITATS DIRECTIVE APPRAISALS

Text for Section 6 remains unchanged.

APPENDIX 1: CONSERVATION OBJECTIVES

unchanged

APPENDIX 2: AIR QUALITY ASSESSMENT

unchanged

APPENDIX 3: UNDERWATER NOISE ASSESSMENT

unchanged

APPENDIX 4: COASTAL PROCESSES ASSESSMENT

New deposition modelling report entitled '*Modelling Report on predicted cumulative deposition of silts within Dublin Bay arising from proposed Dumping at Sea Activities under S0024-02, S0004-03 and S0033-01*' and dated March 2022 now also included in Appendix 4

DUBLIN PORT COMPANY

DUMPING AT SEA PERMIT APPLICATION S0024-02

MP2 Project – Modelling Report on predicted cumulative deposition of silts within Dublin Bay arising from proposed Dumping at Sea Activities under S0024-02, S0004-03 and S0033-01

Deposition Modelling Report
S0024-02
15 March 2022

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Final	Issue to EPA	KC	AKB	AGB	16/03/2022

Approval for issue

Dr A G Barr		16 March 2022

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Declaration

I certify that the information given in this Section 5(2) response is truthful, accurate and complete.

I give consent to the EPA to copy this Section 5(2) response for its own use and to make it available for inspection and copying by the public, both in the form of paper files available for inspection at EPA and local authority offices, and via the EPA's website.

This consent relates to this Section 5(2) response itself and to any further information or submission, whether provided by me as Applicant, any person acting on the Applicant's behalf, or any other person.

Signed by: **Date:** 16th March 2022

(on behalf of the organisation)

Print signature name: Eamon McElroy

Position in organisation: Port Engineer

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APPENDIX A ABR PROJECT SEDIMENT PLUME VALIDATION STUDY REPORT (2020)

1 INTRODUCTION

1.1 Background

Dublin Port Company (DPC) submitted an application to the Environmental Protection Agency (EPA) for a permit under Section 5 of the Dumping at Sea Acts 1996 to 2010 on the 4th August 2020. The application is for the loading and dumping of dredged material arising from capital dredging within Dublin Harbour as part of the MP2 Project. The MP2 Project is the second Strategic Infrastructure Development Project to be brought forward for planning from Dublin Port's Masterplan 2040, reviewed 2018. An Bord Pleanála granted Planning Permission for the MP2 Project on 1st July 2020 (ABP-304888-19).

In September 2021, DPC requested a Supplement to increase both the Loading Area and Volume in the vicinity of the proposed riverside Berths 52 & 53. This change was required to advance the construction of Berth 52, Berth 53 and the Unified Ferry Terminal ahead of programme in order to meet the post Brexit priority demands of national port infrastructure.

The increase to the amount of material to be dredged under the Supplement is 243,673m^3. The overall volume to be dredged under the MP2 Project application is therefore increased from 424,644m^3 to 668,317m^3.

The EPA issued a Section 5(2) Notice: Request for Further Information (RFI) to DPC on 18th February 2022 which included a requirement to undertake a detailed modelling assessment of the predicted deposition of silts within Dublin Bay from dumping activities, cumulatively across the MP2 Project (S0024-02), the Dublin Port 2022-2029 Maintenance Dredging Programme (S0004-03) and the Dublin Harbour Capital Dredging Project (S0033-01) Dumping at Sea Permit applications.

The results of this assessment are presented in this Technical Modelling Report.

1.2 Overview of dumping at sea activities

In the interest of clarity, the maximum total volume of material to be dredged as part of the MP2 Project (S0024-02), the Dublin Port 2022-2029 Maintenance Dredging Programme (S0004-03) and the Dublin Harbour Capital Dredging Project (S0033-01) is summarised in the following sections of this report.

1.2.1 MP2 Project (S0024-02)

The Total Volume and Quantity of Capital Dredging required by the MP2 Project is set out in Table 1.

Table 1 MP2 Project - Volume and Quantity of Capital Dredging required

Element of Work	Standard depth	Volume (m^3)	Quantity (Tonne, wet Tonnes)
Berths 52 / 53	-10.0m CD	403,268m^3	665,392 T
Channel Widening	-10.0m CD	111,995m^3	184,792 T
Oil Berth 3	-13.0m CD	83,414m^3	137,633 T
Berth 50A	-11.0m CD	69,640m^3	114,906 T
Total Volume / Quantity to be dredged		**668,317m^3**	**1,102,723 T**

It is intended to undertake the capital dredging of Berth 52/ 53 and the Channel Widening in one Winter Season (October 2022 to March 2023), subject to the grant of Dumping at Sea and Foreshore Consents. This equates to 515,263m^3 / 850,184 Tonne (wet weight).

The capital dredging of Oil Berth 3 and Berth 50A are scheduled to commence no sooner than 2028 and will likely be over a number of winter seasons depending on the construction sequence which remains subject to detailed design. In the unlikely event that Oil Berth 3 and Berth 50A were dredged in a single Winter Season, this would equate to 153,054m^3 / 252,539 Tonne (wet weight).

The maximum volume / quantity to be dredged over a single Winter Season under S0024-02 is **515,263m^3 / 850,184 Tonne (wet weight).**

1.2.2 Dublin Port 2022 – 2029 Maintenance Dredging Programme (S0004-03)

The Total Volume and Quantity of Maintenance Dredging per Summer Season (April – September) requested under S0004-03 is 300,000m^3 per annum / 495,000 T per annum.

The maximum volume / quantity of maintenance dredging required during a single Summer Season will vary depending on the amount of sediment which has accumulated within the navigation channel, basins and berthing pockets from material originating from the Liffey, Tolka and Dodder catchments as well as material entering the navigation channel from Dublin Bay. The navigation channel is particularly vulnerable from severe easterly storm events.

The maximum volume / quantity to be dredged over a single Summer Season under S0004-03 is **300,000m^3 per annum / 495,000 T per annum Tonne (wet weight).**

1.2.3 Dublin Harbour Capital Dredging Project (S0033-01)

The Total Volume and Quantity of Capital Dredging required by the Dublin Harbour Capital Dredging Project is set out in Table 2.

Table 2 Dublin Harbour Capital Dredging Project - Volume and Quantity of Capital Dredging required

Dredge Zone	Volume (m^3)	Quantity (Tonne, Wet Weight)
Zone 1 – Navigation Channel	121,008 m^3	199,663 T
Zone 2 – South Port Berths	26,146 m^3	43,141 T
Zone 3 – Alexandra Basin East	47,020 m^3	77,583 T
Zone 4 – Oil Basin	7,842 m^3	12,939 T
Zone 5 – Ferryport Basin	27,970 m^3	46,150 T
Zone 6 – Riverside Berth 52	127,515 m^3	210,400 T
Zone 7 –Poolbeg Oil Jetty (Berth 48)	11,296 m^3	18,638 T
Dredge Volume (m^3)	368,797 m^3	608,514 T
Siltation / Tolerance / Contingency (m^3)	131,203 m^3	216,486 T
Total Dredge Volume (m^3)	**500,000 m^3**	**825,000 T**

DPC has requested an eight year consent to complete the above capital dredging works. DPC wish to keep the sequence of dredging as flexible as possible. The rationale for this is set out in the Dublin Harbour Capital Dredging Project EIAR, Chapter 2, Section 2.2.7. In summary, the project will need to be delivered through a series of discrete work packages to minimise disruption to existing port activities. The experience of recent years suggests that there can be unforeseen circumstances which impact on the timing of planned project works in Dublin Port. In such circumstances, it is very difficult to predict when individual works packages within the Dublin Harbour Capital Dredging Project should commence.

It is however known that capital dredging under the Dublin Harbour Capital Dredging Project will not commence until the Winter Season (October 2023 to March 2024) because of the anticipated timeframe for receiving Foreshore and Dumping at Sea Consent.

Consequently, there will be no overlap with the capital dredging of Berth 52/ 53 and the Channel Widening under the MP2 Project. There will however be pressure from the Harbour Master to undertake the majority of the capital dredging as soon as it is permitted.

In the unlikely scenario that all the capital dredging were to be completed within one winter dredging season, the maximum volume / quantity to be dredged under S0033-01 is **500,000m^3 / 825,000Tonne (wet weight)**. In this scenario, no overlap would be expected with MP2 Project capital dredging requirements post 2028.

1.2.4 Indicative Dumping at Sea activity programme

An indicative programme of dumping at sea activities associated with S0024-02, S0004-03 and S0033-01 is presented in Figure 1 overleaf. It should be noted that unforeseen circumstances may necessitate that planned dredging and dumping at sea activities occur at a different time as illustrated in this Figure. Such events can include, but would not be limited to the rapid infilling of the approach channel following arduous storm events.

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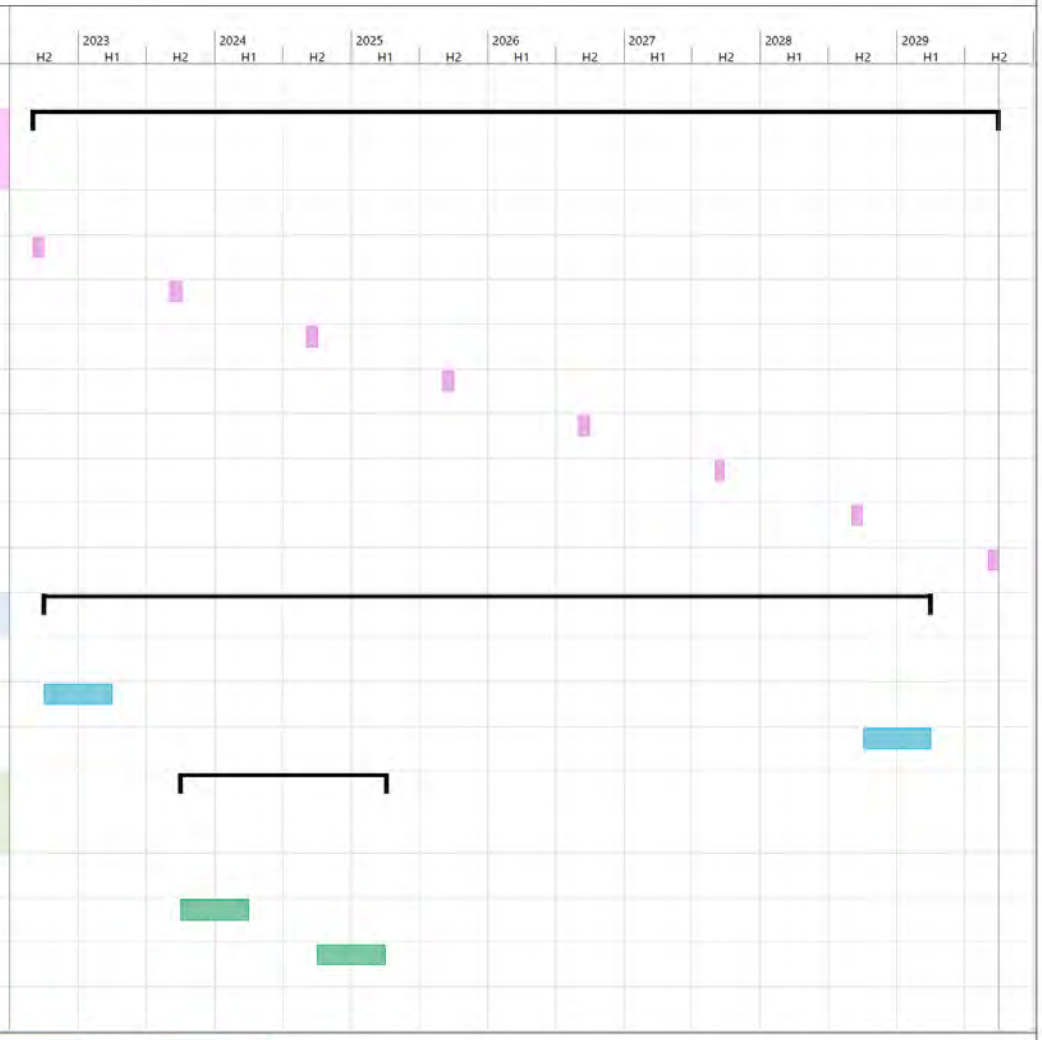
DUBLIN PORT COMPANY

Indicative Dredging Schedule

ID	Task Name	Maximum Volume (m3)	Start	Finish
1				
2	***S0004-03 (Maintenance Dregding)***	***2400000***	***01/09/2022***	28/09/2029
3	**Season**			
4	1	300000	01/09/2022	28/09/2022
5	2	300000	01/09/2023	02/10/2023
6	3	300000	01/09/2024	30/09/2024
7	4	300000	01/09/2025	30/09/2025
8	5	300000	01/09/2026	30/09/2026
9	6	300000	01/09/2027	24/09/2027
10	7	300000	01/09/2028	28/09/2028
11	8	300000	01/09/2029	28/09/2029
12	***S0024-02 (MP2 Capital Dredging***	***668316***	***01/10/2022***	31/03/2029
13	**Element of Work**			
14	Berth 52 & Channel Widenin	515262	01/10/2022	31/03/2023
15	Oil Berth 3 & Berth 50A	153054	02/10/2028	31/03/2029
16	***S0033-01 (Capital Dredging Project)***	***500000***	***02/10/2023***	***04/04/2025***
17	**Season**			
18	1 (inclusive of contingency)	250000	01/10/2023	31/03/2024
19	2 (inclusive of contingency)	250000	01/10/2024	31/03/2025
20				



Date: 14/03/2022

Summary S0004-03 S0024-02 S0033-01

Page 1

Figure 1 Indicative dumping at sea programme for S0024-02, S0004-03 and S0033-01

2 MODELLING APPROACH

For this study, RPS adopted a similar comprehensive modelling approach to that used to validate the Alexandra Basin Redevelopment (ABR) capital dredging programme (RPS, 2020) under Dumping at Sea Permit S0024-01. This involved using detailed recorded information from loading and dumping logs provided by the dredging contractor to create bespoke, site specific sediment source terms that were then applied to a calibrated and validated hydrodynamic model. The Sediment Plume Validation Study Report is presented in Appendix A (RPS, 2020).

This approach involved defining exact spill rates and quantities for 210 individual trips between 09/03/2020 – 28/03/2020 and simulating all 210 trips in a single model. In total, the dispersion and fate of 218,686T Total Dry Solids was represented in one single simulation, with the average quantity of material being disposed of per trip equating to 1,041T TDS (*n* =210, *SD* =126 TDS).

As summarised in Figure 2 below, the output from the ABR Project simulation of recorded trips was then scaled to reflect the dredging and disposal requirements associated with S0024-02, S0004-03 and S0033-01. These scaled results were then combined to provide details on the cumulative impacts from all three projects during the initial dumping and over the full period of the planned projects. This approach was in line with the method used to calculate the total deposition of silt materials in the ABR Project EIS (2014).

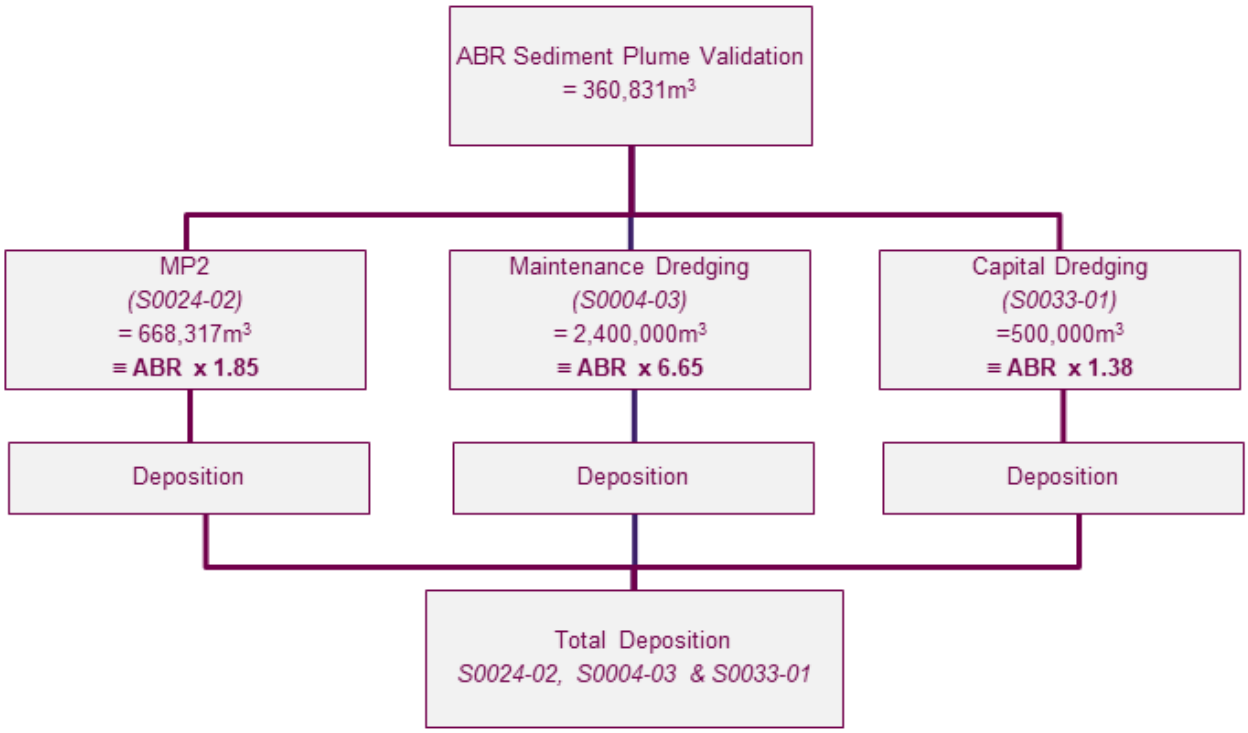


Figure 2 Summary of the modelling approach used to assess the cumulative impact of all three projects

As this approach utilised actual spill rates and quantities, it was considered more reflective of future dumping at sea activities relative to previous work completed for the ABR Project EIS and MP2 Project EIARs which, owing to the lack of specific information, both represented the sediment source term using a constant spill rate during previous model simulations. The location of the dredge hopper during the disposal of sediment during 3 of the 210 dumping activities is illustrated in Figure 3 overleaf.

The coupled MIKE 21 sediment transport model was used to simulate the fate of the silt released from the Trailing Suction Hopper Dredger (TSHD) over the dump site by moving a sediment source along the track that the barge would take as it traversed the dump site area during the disposal operation. The model then simulated the dispersion, deposition of silt material in response to the tidal currents throughout the model area.

The location of the licenced offshore dump site at the approaches to Dublin Bay, west of the Burford Bank is presented in Figure 4.

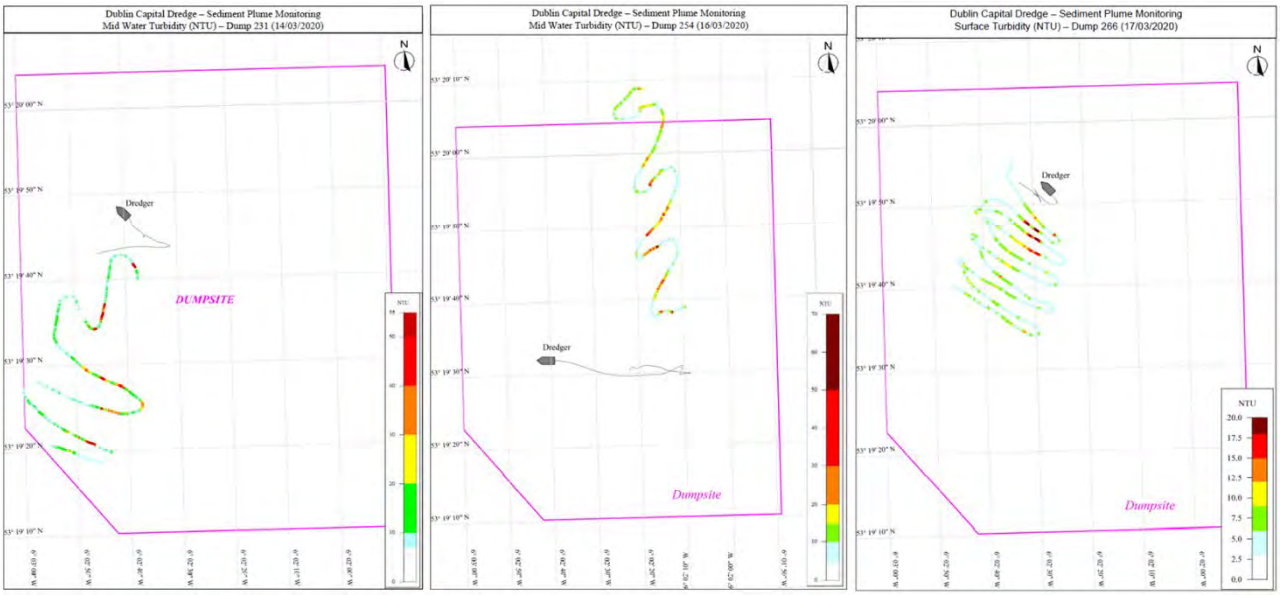


Figure 3 TSHD track during the disposal of sediment across three individual dumping activities (trips) with the corresponding measured suspended sediment concentration

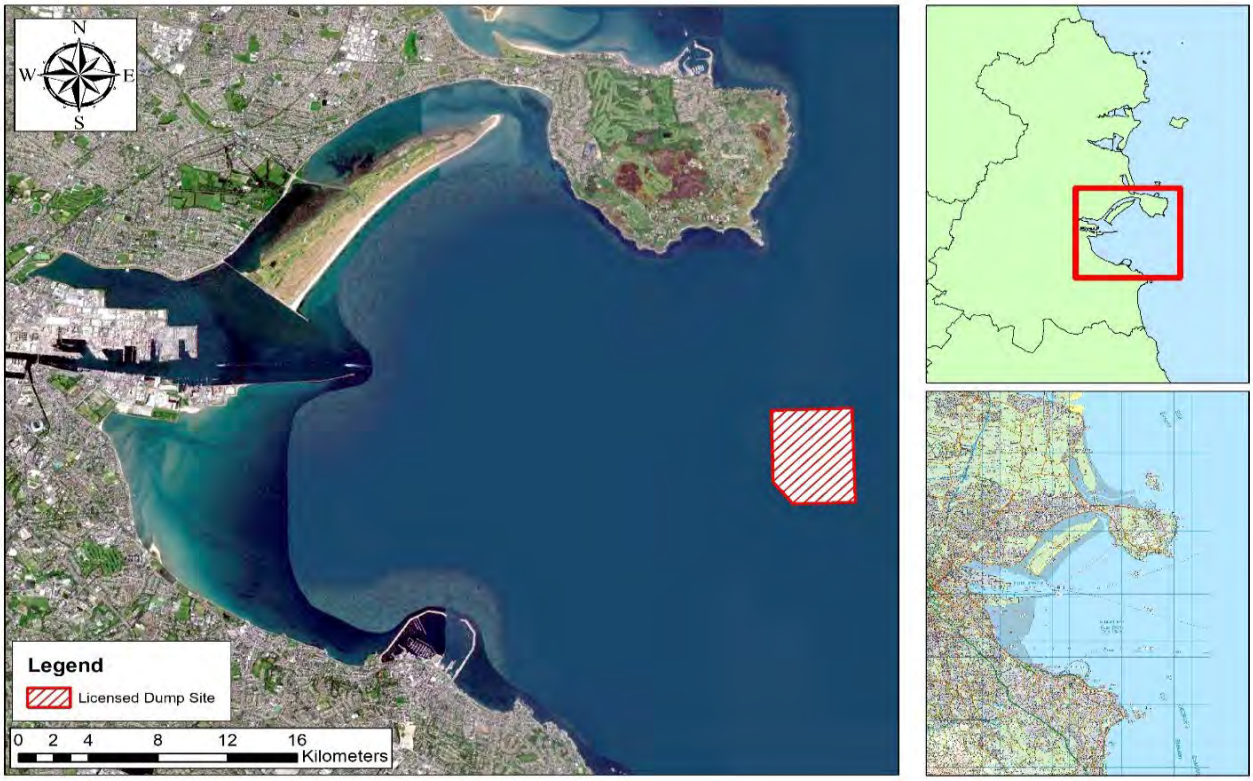


Figure 4 Location of the licenced offshore dump site at the approaches to Dublin Bay, west of the Burford Bank

3 COMPUTATIONAL MODELS

3.1 Modelling Overview

RPS used the MIKE 21 hydrodynamic numerical modelling software package developed by DHI, to undertake the sediment plume simulations presented in Section 4 of this report.

The MIKE system is a state of the art, industry standard, modelling system, based on a flexible mesh approach. This software was developed for applications within oceanographic, coastal and estuarine environments.

A brief synopsis of the MIKE system and modules used for this assessment is outlined below:

- **MIKE 21 FM system -** Using this flexible mesh modelling system, it was possible to simulate the mutual interaction between currents, waves and sediment transport by dynamically coupling the relevant modules in two dimensions.
    - **The Hydrodynamic (HD) module -** This module is capable of simulating water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The HD Module is the basic computational component of the MIKE 21 Model system providing the hydrodynamic basis for the Sediment Transport and Spectral Wave modules. The Hydrodynamic module solves the two-dimensional incompressible Reynolds averaged Navier-Stokes equations subject to the assumptions of Boussinesq and of hydrostatic pressure. Thus the module consists of continuity, momentum, temperature, salinity and density equations. In the horizontal domain both Cartesian and spherical coordinates can be used.
    - **The Sediment Transport module** - The Sediment Transport Module simulates the erosion, transport, settling and deposition of cohesive sediment in marine and estuarine environments and includes key physical processes such as forcing by waves, flocculation and sliding. The module can be used to assess the impact of marine developments on erosion and sedimentation patterns by including common structures such as jetties, piles or dikes. Point sources can also be introduced to represent localised increases in current flows as a result of outfalls or ship movements etc.

3.2 Computational Models and Data Sources

RPS' model of Dublin Bay was created using flexible mesh technology to provide detailed information on the coastal processes around the licenced dump site and Dublin Port as well as the wider Dublin Bay area. The model uses mesh sizes varying from 250,000m^2 (equivalent to 500m x 500m squares) at the outer boundary of the model down to a very fine 225 m^2 (equivalent to 15m x 15m squares) in Dublin Port and around the licenced dump site. The extent, mesh structure and bathymetry of this model is presented in Figure 5.

The bathymetry of this model was developed using data gathered from hydrographic surveys of Dublin Port, the Tolka estuary and the dump site since 2017 to present. This resource was supplemented by data from the Irish National Seabed Survey, INFOMAR and other local surveys collated by RPS for the Irish Coastal Protection Strategy Study (RPS, 2003).

Tidal boundaries for the Dublin Bay model shown in Figure 5 were taken from the Irish Coastal Protection Strategy Study (ICPSS) tidal surge mode. This model was developed using flexible mesh technology with the mesh size varying from *c.* 24km along the offshore Atlantic boundary to *c.* 200m around the Irish coastline. This validated model is run three times daily on behalf of the Office of Public Works (OPW) to provide detailed tidal information around the coast of Ireland. The extent and bathymetry of this model is illustrated in Figure 6.

Boundary conditions used to represent the mean annual river flows for the Liffey, Dodder and Tolka were set at 15.6, 2.3 and 1.4m^3/s respectively.

It should be noted that the same computational models used to support the environmental assessment of the ABR Project (RPS, 2014) were used for this technical assessment. A previous calibration and validation exercise that utilised recorded data from throughout Dublin Bay concluded that the Dublin Bay model performed very well and provided a very good representation of the coastal processes in Dublin Port and Dublin Bay.

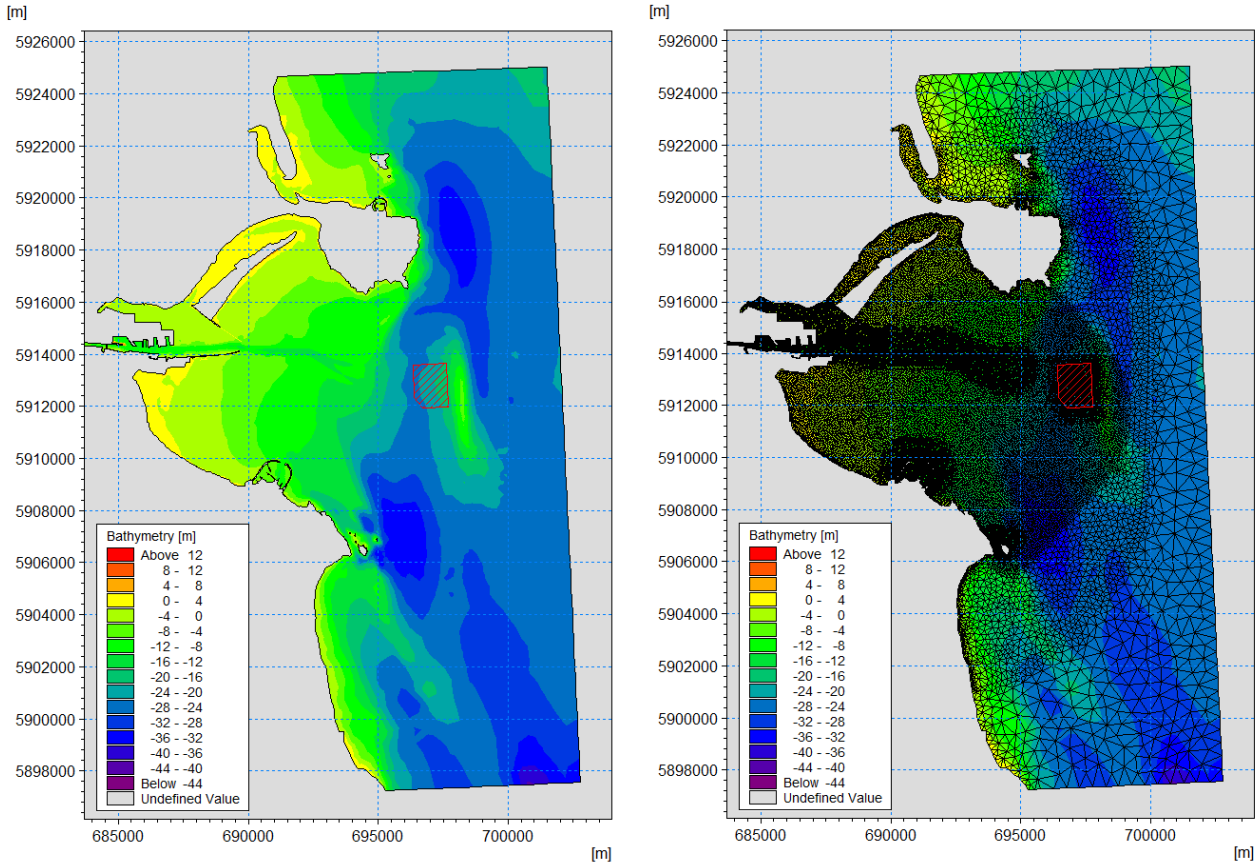


Figure 5 Extent and bathymetry (left) and mesh structure (right) of the Dublin Bay model. Location of the licenced dump site shown by red hatch area.

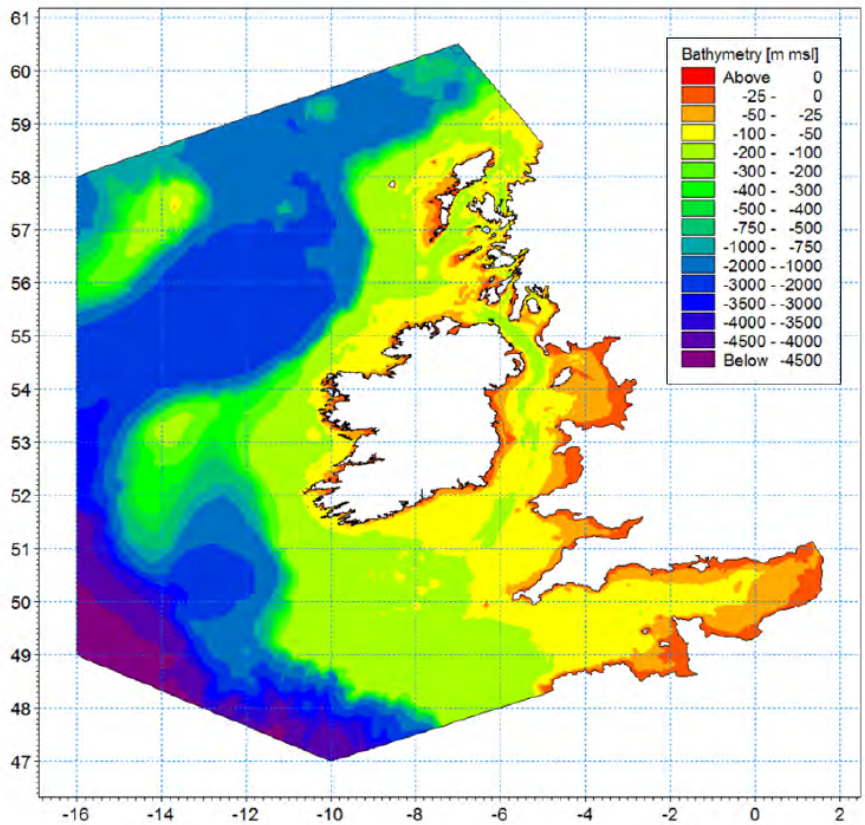


Figure 6 Extent and bathymetry of Irish Sea Tidal and Storm Surge model

4 OUTPUT FROM SEDIMENT PLUME MODELLING

The numerical modelling work undertaken in support of the Alexandra Basin Redevelopment (ABR) Project (RPS, 2014) specified sediment material as being characterised by three discrete fractions with mean diameters of 200µm, 20µm and 3µm with each fraction constituting 1/3 of the total volume dredge material. This specification was based on Particle Size Distributions (PSDs) of sediment samples collected from the Harbour area (RPS, 2014).

An exercise to validate the characterisation of this sediment concluded that the sediment was specified correctly during the initial ABR modelling exercise (RPS 2020). As such, all model simulations in this study were undertaken using sediment parameters reflective of an equally split 200µm, 20µm and 3µm mixture.

4.1 Silt deposition arising from each dredging project

The coarser fraction of the silt, i.e., the sand fraction that had a mean grain size of 200µm was found to behave differently relative to the two finer fractions that had mean grain diameters of 20µm and 3µm in that it remained almost exclusively within the immediate vicinity of the licenced dump site. Conversely, the two finer silt fractions were carried away by the tidal currents towards the expanse of the Irish Sea.

The predicted total deposition of the silt fractions of the total dredge material disposed under S0024-02, S0004-03 and S0033-01 is presented in Figure 7 to Figure 9 respectively. As demonstrated by these Figures, the maximum total deposition of silt material within Dublin Bay does generally not exceed 0.40g/m^2.

It should be noted that this is marginal lower than the 0.50g/m^2 as reported in the Additional Sediment Plume Modelling Response to Section 5(2) Notice (RPS, 2021). This can be attributed to how the sediment source term was specified. In previous work including for the ABR Project EIS (RPS, 2014), the source term was defined as a constant spill rate of 108kg/s that was only activated when the dredger was over the dump site. For this assessment, a bespoke source term was defined for each of the 210 individual trips based on dumping logs provided by the dredging contractor. Each source term had a unique spill rate reflective of the corresponding dumping profile. In most instances, spill rates were much higher but persisted for shorter durations.

Given the higher spill rates and suspended concentrations, sediments tended to floc together and settle much faster. As a consequence, more silt material remained within the vicinity of the dump site and less silt material dispersed and settled throughout Dublin Bay.

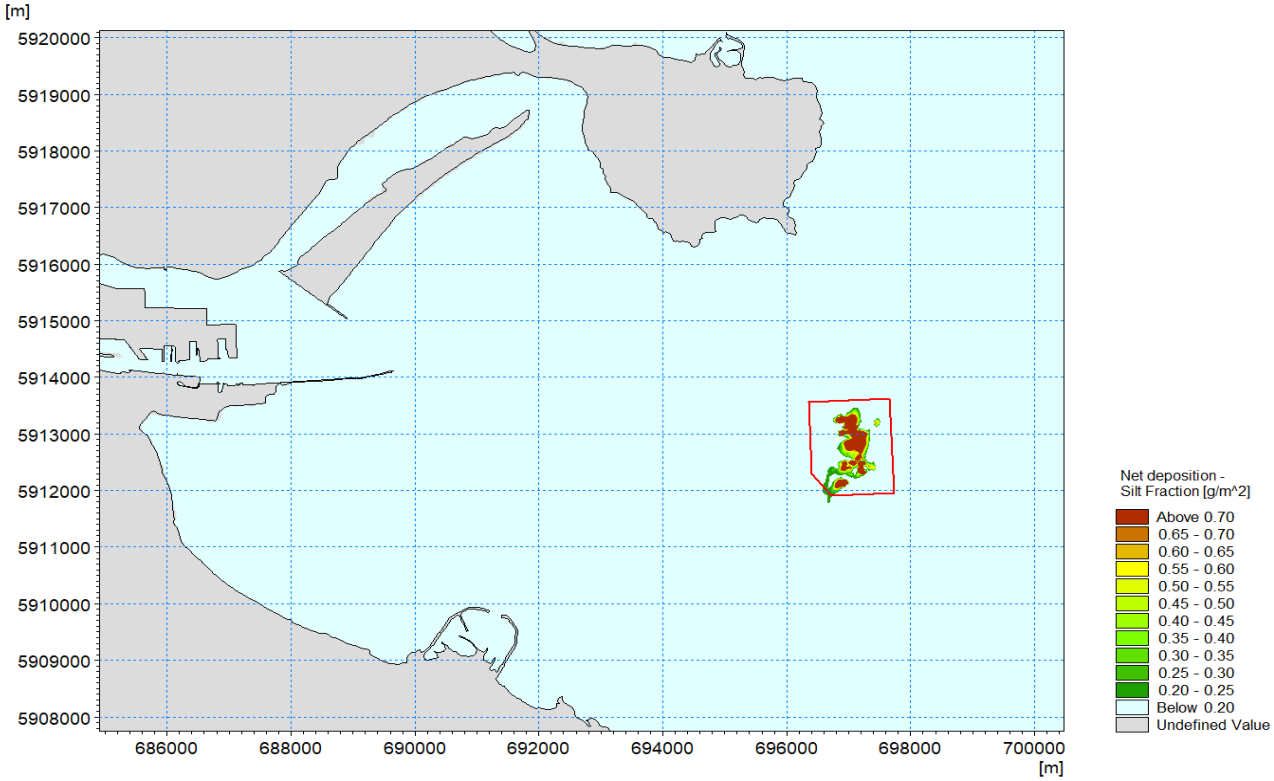


Figure 7 Total deposition of silt material following the dumping at sea activities associated with the MP2 Project (S0024-02)

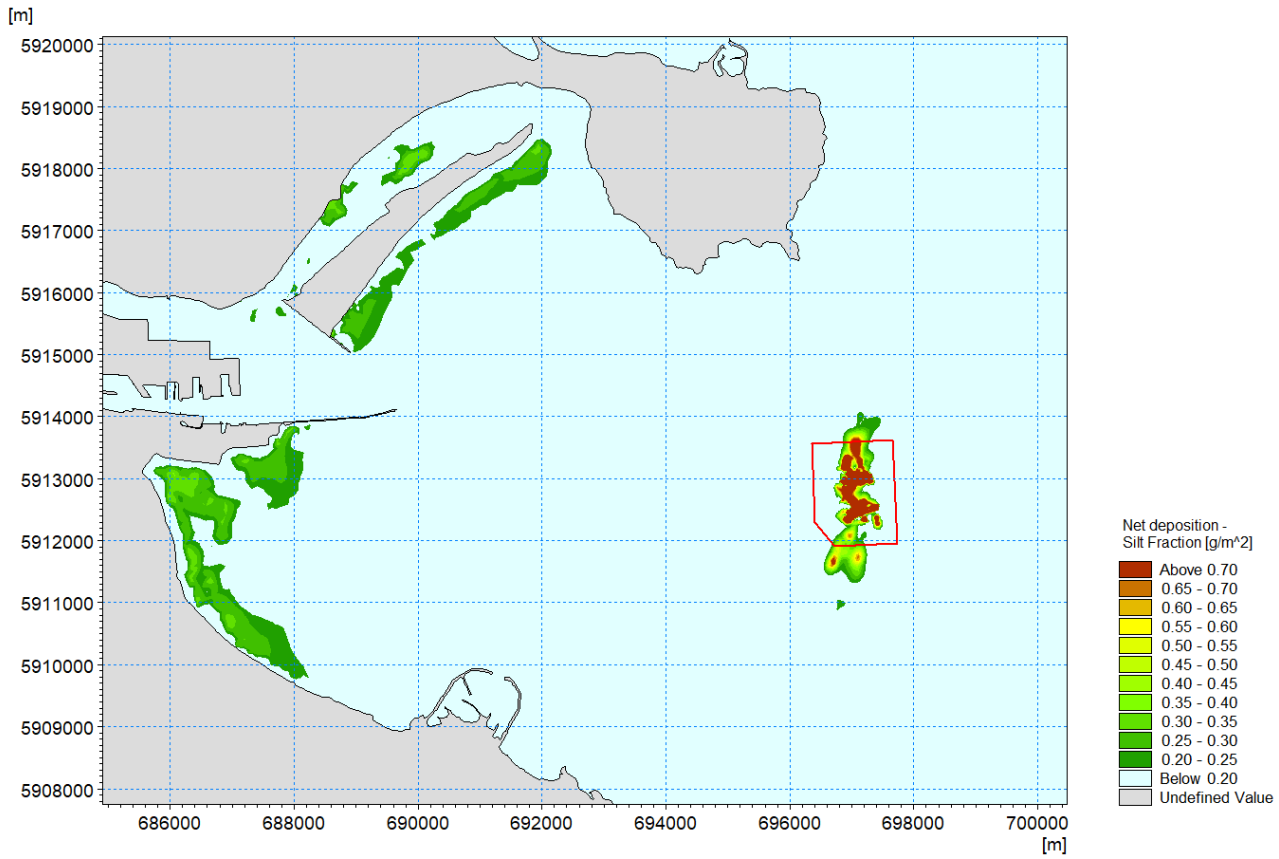


Figure 8 Total deposition of silt material following the dumping at sea activities associated with the Dublin Port 2022 - 2029, Maintenance Dredging Programme (S0004-03)

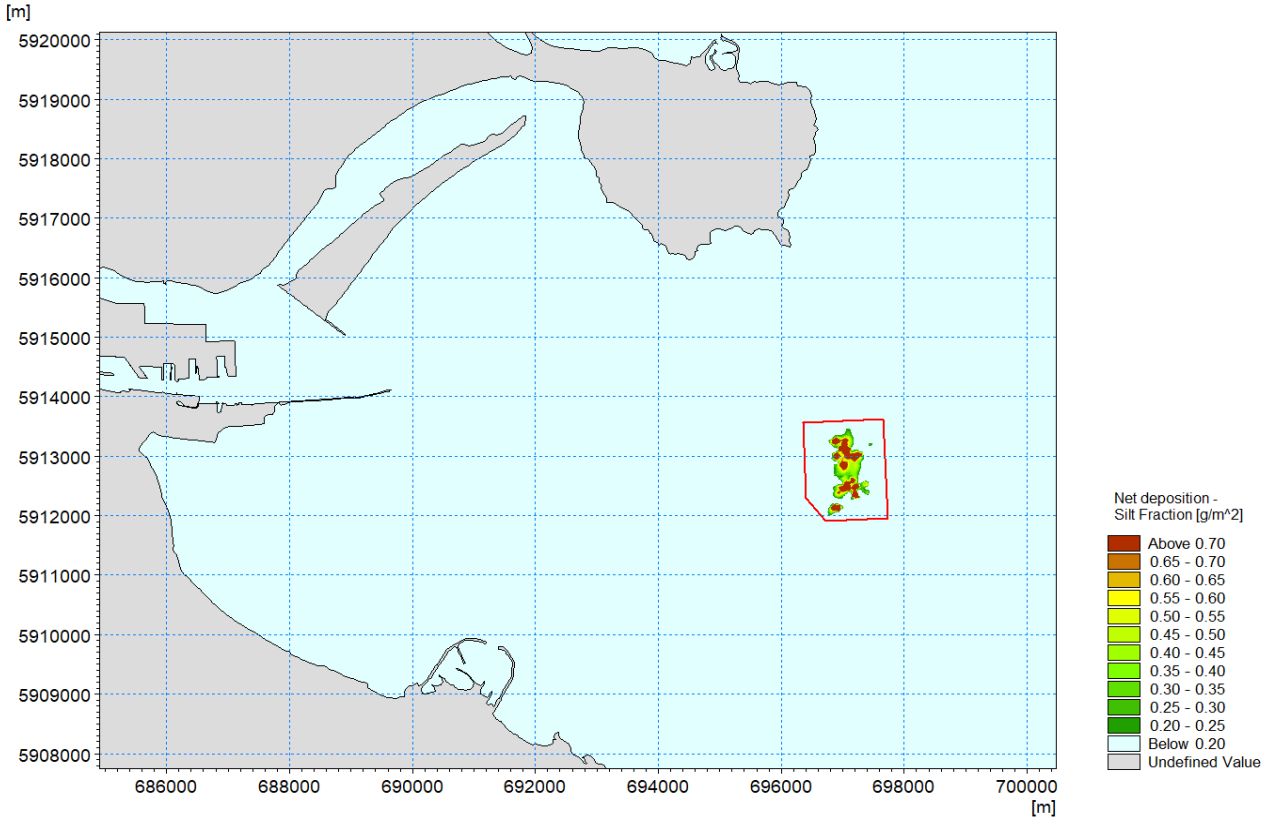


Figure 9 Total deposition of silt material following the dumping at sea activities associated with the Dublin Harbour Capital Dredging Project (S0033-01)

4.2 Cumulative silt deposition from all three dredging projects (S0024-02, S0004-03 and S0033-01)

The cumulative sediment deposition within Dublin Bay as a result of all three dumping at sea activities described in the previous Section is presented in Figure 10. As demonstrated by this Figure, the cumulative total deposition of silt material is generally less than 0.55g/m^2. This magnitude of deposition translates to a maximum change in bed level thickness of *c.* 0.40µm as illustrated in Figure 11. This is less than the width of a human hair and is not measurable in the field.

For context, the estimated natural sediment load from the upstream Liffey catchment is estimated at circa 200,000 tonnes per annum (DPC Maintenance Dredge AER 2017, Dumping at Sea Permit S0004-01). If dispersed over the Port area between East Link and Poolbeg Lighthouse and the Tolka Estuary; this is roughly equivalent to a natural sediment load of 30 kg/m^2 in any year (30,000 g/m^2). This is equivalent to an average depth of 2cm (based on a silt material).

It is clear that the impact of sediment deposition from dumping activities is several magnitudes lower compared to natural sedimentation and can therefore be considered to be *de minimis*.

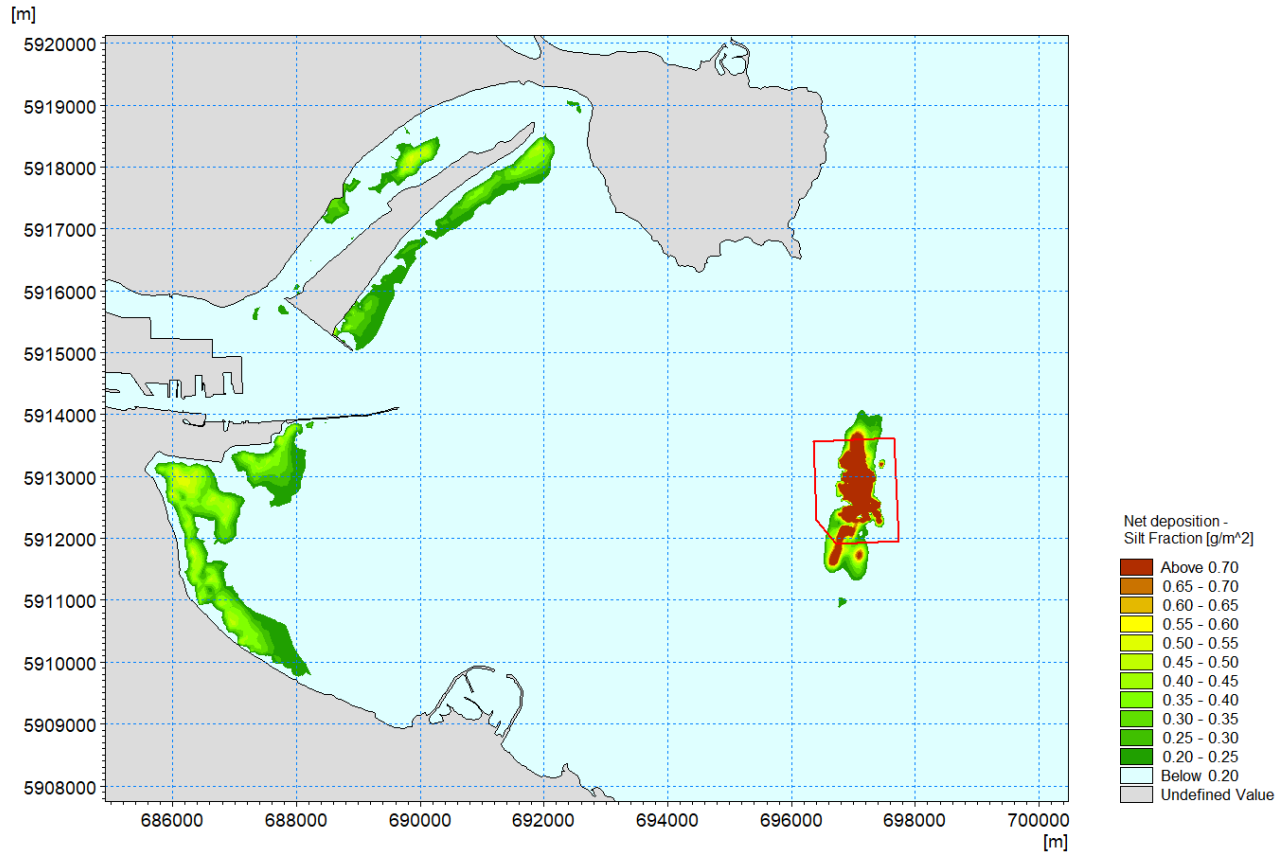


Figure 10 Cumulative total deposition of silt material following the dumping at sea activities associated with S0024-02, S0004-03 and S0033-01

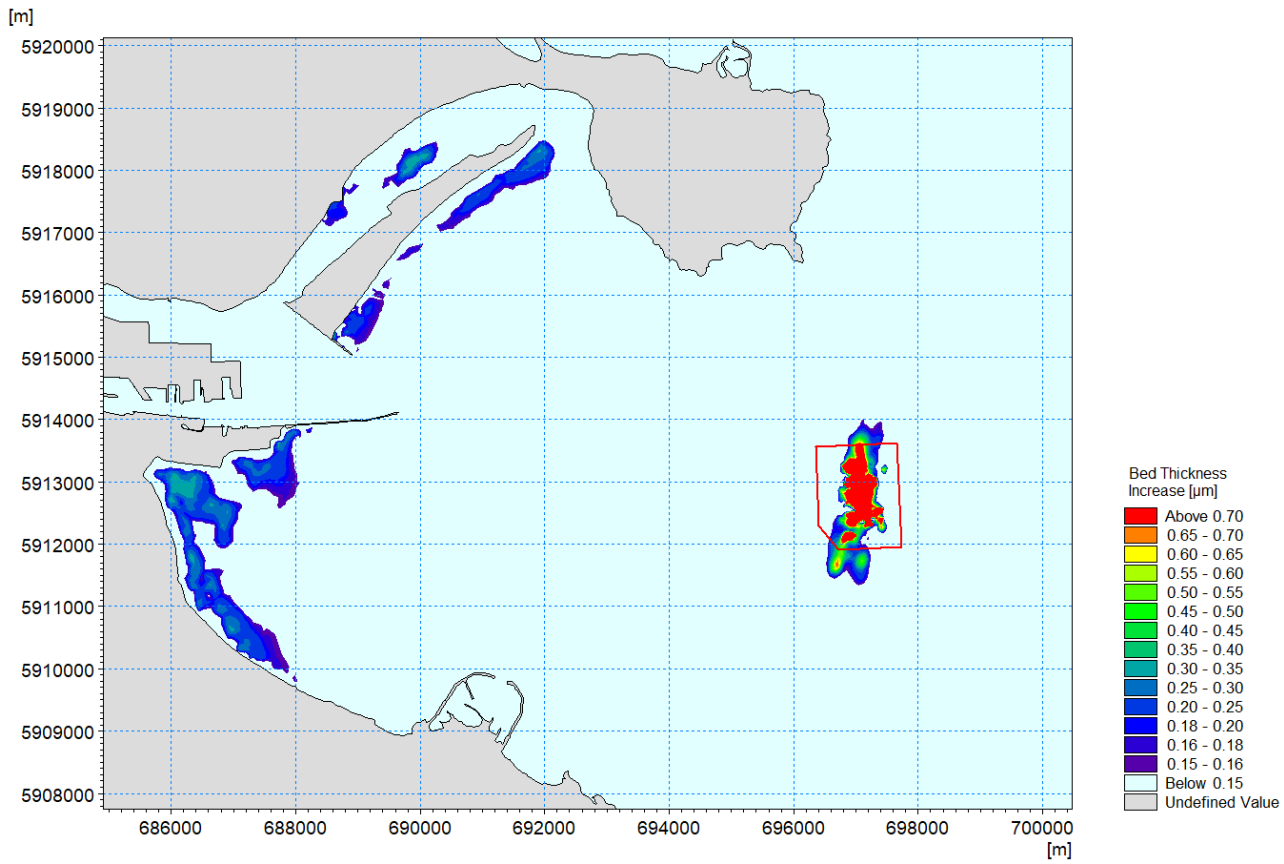


Figure 11 Cumulative bed thickness increase as a result of silt deposition from S0024-02, S0004-03 and S0033-01

5 CONCLUSIONS

Dublin Port Company (DPC) submitted an application to the Environmental Protection Agency (EPA) for a permit under Section 5 of the Dumping at Sea Acts 1996 to 2010 on the 4th August 2020. The application is for the loading and dumping of dredged material arising from capital dredging within Dublin Harbour as part of the MP2 Project. The MP2 Project is the second Strategic Infrastructure Development Project to be brought forward for planning from Dublin Port's Masterplan 2040, reviewed 2018. An Bord Pleanála granted Planning Permission for the MP2 Project on 1st July 2020 (ABP-304888-19).

The EPA issued a Section 5(2) Notice: Request for Further Information (RFI) to DPC on 18th February 2022. This RFI requested additional modelling to describe the deposition of silts arising from three permit applications (S0024-02, S0004-03 and S0033-01) and the impact on the receiving environment.

In response to this statutory requirement, DPC commissioned RPS to undertake additional sediment transport modelling to describe the fate of sediments arising from the dumping activities associated with (S0024-02, S0004-03 and S0033-01).

Using an approach that was improved by the availability of detailed logs provided by the dredging contractor and thus actual spill rates for 210 individual trips, modelling simulations that were undertaken to validate the Alexandra Basin Redevelopment (ABR) dredging programme (RPS, 2020) were repeated for this study. Output from these simulations were then scaled and combined to assess and quantify the cumulative impacts from all three projects during the initial dumping and over the full period of the planned projects.

This assessment demonstrated that the maximum total deposition of silt material within Dublin Bay resulting from the disposal of dredge material under S0024-02, S0004-03 and S0033-01 did not exceed 0.55g/m^2.

The resultant cumulative total deposition of silt material (i.e., change in bed level thickness) in Dublin Bay was generally less than 0.40µm. This is less than the width of a human hair and is not measurable in the field.

For context, the estimated natural sediment load from the upstream Liffey catchment is estimated at about 200,000 tonnes per annum (DPC Maintenance Dredge AER 2017, Dumping at Sea Permit S0004-01). If dispersed over the Port area between East Link and Poolbeg Lighthouse and the Tolka Estuary; this is roughly equivalent to a natural sediment load of 30 kg/m2 in any year (30,000 g/m2). This is equivalent to an average depth of 2cm (based on a silt material).

6 BIBLIOGRAPHY

Hydromaster Dublin Bay Sediment Plume Monitoring Report [Report]. - 2020.

RPS ABR Sediment Plume Validation Study [Report]. - 2020.

RPS Additional Sediment Plume Modelling, Response to Section 5(2) Notice [Report]. - 2021.

RPS Alexandra Basin Redevelopment Project - Construction Environmental Management Plan [Report]. - 2018.

RPS Alexandra Basin Redevelopment Project - Environmental Impact Statement [Report]. - 2014.

RPS Irish Coastal Protection Strategy Study [Report]. - 2003.

Appendix A

ABR Project Sediment Plume Validation Study Report (2020)

ALEXANDRA BASIN REDEVELOPMENT (ABR) PROJECT

CAPITAL DREDGING PROGRAMME

Sediment Plume Validation Modelling

IBE1686 Sediment Plume
Validation Modelling
Final
9 September 2020

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Appendices

Appendix A Hydromaster Survey Monitoring Tracks and Comparison with Model Simulations

1 INTRODUCTION

1.1 Background

Dublin Port Company (DPC) was granted a Dumping at Sea Permit (S0024-01) by the Environmental Protection Agency (EPA) on 13th September 2016 for the loading and dumping at sea of dredged material arising from capital dredging as part of the Alexandra Basin Redevelopment (ABR) Project. The permit sets out in detail the conditions under which DPC will carry out loading and dumping at sea operations and the required monitoring programmes.

Condition 4.11 of the Dumping at Sea Permit sets out the sediment plume monitoring at the dump site required to enable the horizontal and vertical extent of the sediment plume generated by the permitted dumping activity at different stages of the tide to be measured.

"The permit holder shall carry out sediment plume monitoring in the vicinity of the dumping activity during the first dumping campaign and thereafter as may be required by the Agency." Condition 4.11.1

Furthermore, "The results of the sediment plume monitoring, together with the results of the hydrographic monitoring, shall be used to validate the sediment transport model presented in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application." Condition 4.11.3

In response to this statutory requirement, DPC commissioned Techworks Marine Ltd to undertake a comprehensive sediment plume monitoring programme and RPS to undertake a modelling validation study during the first winter dredging campaign (October 2017 to March 2018). The results of this study are presented in the Dumping at Sea Permit S0024-01 Annual Environmental Report 2017.

1.1.1 Review of Sediment Plume Monitoring undertaken during the First Winter Capital Dredging Campaign (October 2017 – March 2018) in Dublin Bay

The first winter dredging capital dredging campaign commenced on 22nd October 2017 and Techworks Marine Ltd undertook their first sediment plume monitoring survey on 27th October 2017 whilst loading and dumping activity was taking place.

The survey was undertaken in full compliance with methodology agreed with the EPA. Turbidity was measured close to the water surface using a meter attached to a small craft (RIB). The location of the turbidity transects were designed to record the full extent of the dredge plume, beyond the footprint of the dump site.

The recorded turbidity levels at 1m below the surface did not differ within the dumping area and in adjacent areas outside the dumping site or at a background site. The results therefore showed that the released dredge spoil did not create a significant dredge plume within the surface waters. This suggests that the dredged material fell rapidly towards the seabed.

All loading and dumping activity during the first winter capital dredging season was confined to one section of the navigation channel and fairway within Dublin Bay (AER 2017, Appendix 2.2). The dredged material is predominately fine sand throughout the dredge area so the behaviour of any sediment plume arising from the dumping operations was expected to be similar for all loading and dumping trips.

Based on the results of the first sediment plume monitoring survey, it was clear that that the monitoring programme needed to be adapted in order to gain a better understanding of the dispersion and fate of marine sediments during dumping operations.

Techworks Marine Ltd therefore designed an adapted dredge plume monitoring programme that measured in-situ turbidity depth profiles at nine locations in the vicinity of the dump site and at a control site. A survey based on this technique took place on 4th December 2017 during loading and dumping operations.

Again, the recorded turbidity levels were low and no significant differentiation could be made between turbidity levels recorded at the dump site and at the background, control site. Techworks Marine Ltd concluded that sediment appears to settle rapidly and proximally to the release point within the dumping site.

At this point, RPS undertook model simulations of the dredge trips that coincided with the dredge plume monitoring surveys. The results are reported in the Annual Environmental Report (AER) 2017 (pages 75 – 84). The model simulations showed that the sediment was predicted to settle rapidly and proximally to the release point within the dumping site in agreement with the survey results.

Techworks Marine Ltd determined that there was no further scientific value in undertaking further plume monitoring surveys during the first winter capital dredging season. This was because that the dredging operations were confined to one section of the navigation channel and fairway within Dublin Bay and the dredged material was predominately a fine sand throughout the dredge area. As such, the behaviour of any sediment plume arising from the dumping operations was expected to be similar for all loading and dumping trips.

1.1.1.1 Conclusions

The following conclusions can be drawn from the review of Sediment Plume Monitoring undertaken during the First Winter Capital Dredging Campaign (October 2017 – March 2018):

- A sediment plume monitoring programme was established in full compliance to the monitoring protocols agreed with the EPA.
- The results of the first sediment plume monitoring survey showed that the released dredge spoil did not create a significant dredge plume within the surface waters. This suggests that the dredged material fell rapidly towards the seabed.
- Based on the results of the first sediment plume monitoring survey, it was clear that that the monitoring programme needed to be adapted in order to gain a better understanding of the dispersion and fate of marine sediments during dumping operations.
- An adapted dredge plume monitoring programme was developed which measured in-situ turbidity depth profiles at nine locations in the vicinity of the dump site and at a control site. Again, the recorded turbidity levels were low and no significant differentiation could be made between turbidity levels recorded at the dump site and at the background, control site. The sediments appear to settle rapidly and proximally to the release point within the dumping site.
- Model simulations of the dredge trips that coincided with the dredge plume monitoring surveys showed that the sediment was predicted to settle rapidly and proximally to the release point within the dumping site in agreement with the survey results.
- There was no further scientific value in undertaking further plume monitoring surveys during the first winter capital dredging season, given the dredging operations were confined to one section of the navigation channel and fairway within Dublin Bay. In addition, the dredged material was predominately a fine sand throughout the dredge area so the behaviour of any sediment plume arising from the dumping operations was expected to be similar for all loading and dumping trips.

1.1.2 Change in Scope – Proposed Sediment Plume Monitoring within the inner Liffey channel

Schedule B.2.4 of the Dumping at Sea Permit requires the Permit Holder to undertake sediment plume monitoring during the first dumping campaign and thereafter as may be required by the Agency.

The AER 2017 sets out the results of the sediment plume monitoring undertaken during the first dumping campaign. The results, as summarised above, demonstrate that for loading and dumping activity within Dublin Bay, sediments settle rapidly and proximally to the release point within the dumping site. This is consistent with the findings of computational modelling (Section 10.6 of the AER 2017).

Based on the results of the sediment plume monitoring undertaken during the first dumping campaign, DPC believes that further sediment plume monitoring for loading and dumping of sediments sourced from the navigation channel and fairway within Dublin Bay would be of no additional scientific value.

DPC however proposed that further sediment plume monitoring and model validation would be undertaken when dredging commenced within the inner Liffey channel. The material to be dredged in this area contains a highly silt content and model simulations showed that the silts where expected to be dispersive in nature during dumping operations.

In accordance with Condition 4.4 of Dumping at Sea Permit S0024-01, DPC proposed this amendment to the scope of the sediment plume monitoring requirements to the EPA, which was subsequently accepted.

1.1.3 Sediment Plume Monitoring undertaken during the Third Winter Capital Dredging Campaign (October 2019 – March 2020) within the inner Liffey channel

Capital dredging within the inner Liffey channel (Dublin Harbour) took place in February - March 2020 during third winter dredging capital dredging campaign (October 2019 – March 2020).

DPC appointed Hydromaster Ltd to undertake a comprehensive sediment plume monitoring survey during the dumping operations (March 2020). Hydromaster's monitoring report is presented separately (Hydromaster, 2020).

DPC appointed RPS to undertake a modelling validation study using the results of the sediment plume monitoring survey undertaken by Hydromaster.

This technical report describes the numerical modelling programme undertaken using results of the sediment plume monitoring, together with the results of hydrographic monitoring, to validate the sediment transport model presented in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application.

The location of the licenced offshore dump site at the approaches to Dublin Bay, west of the Burford Bank is where permitted dumping activities took place is presented in Figure 1.1.

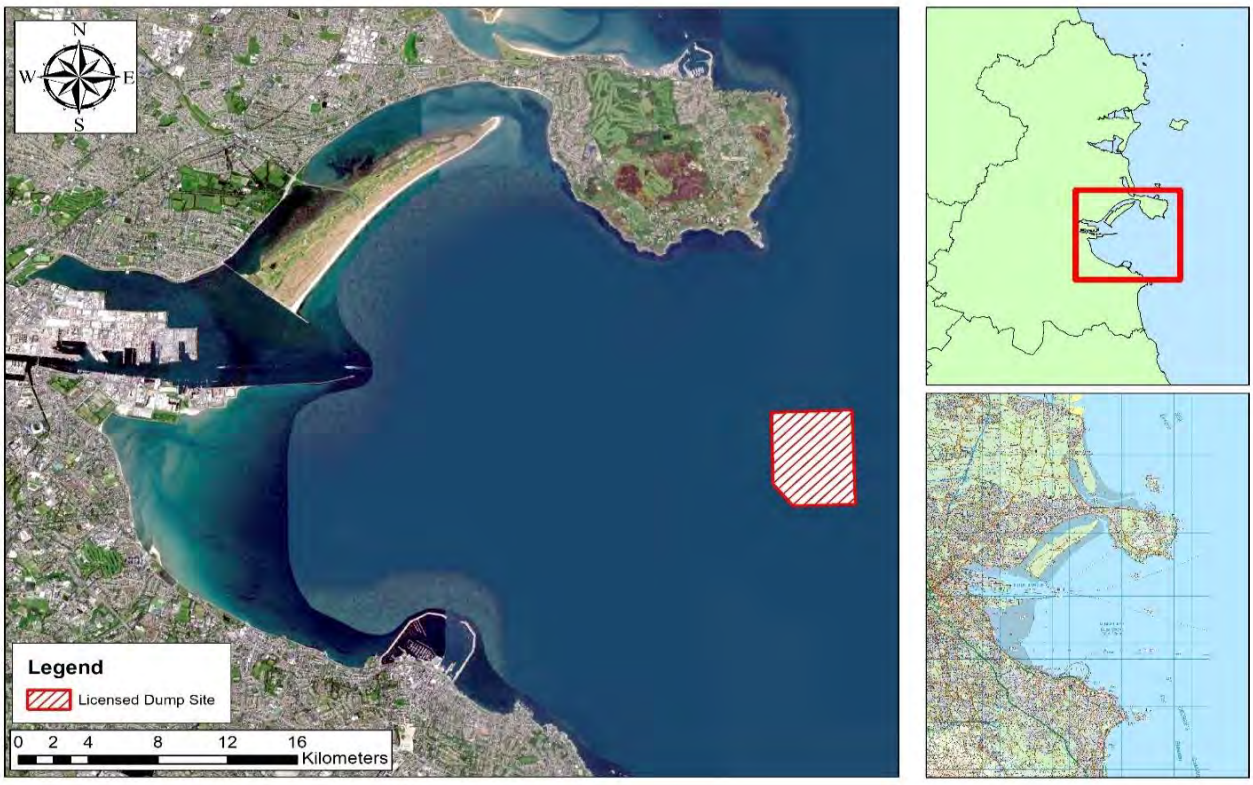


Figure 1.1: Location of the licenced offshore dump site at the approaches to Dublin Bay, west of the Burford Bank

2 OVERVIEW OF THE DUMPING AT SEA CAMPAIGN

2.1 Dredging programme

Based on detailed loading and dumping logs provided by the dredging contractor, the capital dredging campaign in March 2020 comprised 210 individual trips between 09/03/2020 – 28/03/2020 and involved the loading and dumping of 218,686 Total Dry Solids. The quantity of material disposed of per trip averaged 1,041T TDS (*n* =210, *SD* =126 TDS). No overspill of dredged material was permitted within the inner Liffey channel.

Owing to the turbulent nature of the dredging process it was not possible to d characterise and quantity the composition of dredge material during each trip. However, it was reported that the dredge material was generally dominated by silt and sand material with a smaller fraction of gravel.

2.2 Equipment

The dredging and disposal activities under Dumping at Sea Permit S0024-01 were undertaken by Irish Dredging a subsidiary of Royal Boskalis Westminster N.V. The vessel used was the purpose built 4,500m^3 trailing suction hopper dredger "Shoalway" which is illustrated in Figure 2.1 below. This 90m vessel was specifically designed for dredging operations within harbour environments.

Figure 2.1: The trailing suction hopper dredger "*Shoalway*" used for the March 2020 capital dredging campaign within the inner Liffey channel

3 OVERVIEW OF SEDIMENT PLUME MONITORING PROGRAMME

DPC commissioned Hydromaster Ltd to undertake a detailed sediment plume monitoring programme to gather robust data, representative of a range of tidal conditions, which could be used to validate computational plume simulations of the dumping activity. A total of 20 trips were monitored by Hydromaster as summarised in Table 3.1.

Table 3.1: Summary of the 20 dumping trips monitored by Hydromaster between 14th March and 27th March 2020

Date	Dump Trip	Start of Dump Activity	Dump Duration (min)	Turbidity Survey data available?	Corresponding detailed dredge log data available?
14/03/2020	231	17:44:42	11	✓	✓
16/03/2020	254	11:07:52	17	Mid layer data only	✓
17/03/2020	266	09:18:20	13	✓	✓
	267	10:57:09	16	✓	✓
	268	12:40:12	17	✓	✓
18/03/2020	280	08:42:53	15	✓	✓
	281	10:22:01	13	Surface layer data only	✓
	282	12:16:22	14	Surface layer data only	✓
	283	13:41:42	19	✓	✓
19/03/2020	284	08:42:05	17	✓	✗
	286	11:51:01	18	✓	✗
	287	14:12:02	14	✓	✗
	288	16:29:44	19	✓	✗
25/03/2020	356	10:36:15	11	✓	✗
	357	12:08:52	14	✓	✗
	360	17:46:03	17	✓	✗
27/03/2020	373	15:08:51	24	✓	✓
	374	17:02:36	26	✓	✓
	375	19:03:41	14	✓	✓

Note: Only the total dredge quantity per trip was available for 19th and 25th March 2020.

It should be noted that the turbidity measurements show how cloudy/clear the seawater is and is measured in Nephelometric Turbidity Units (NTU). An assessment of sediment samples taken from the inner Liffey channel and Dublin Bay identified a clear relationship between the Total Suspended Solids (TSS) within the seawater and Turbidity (NTU) (RPS, 2018). As shown in Figure 3.1, this assessment found that seawater dominated by silts and sands had a NTU to TSS conversion factor of *c.* 2.5 and 1.5 respectively.

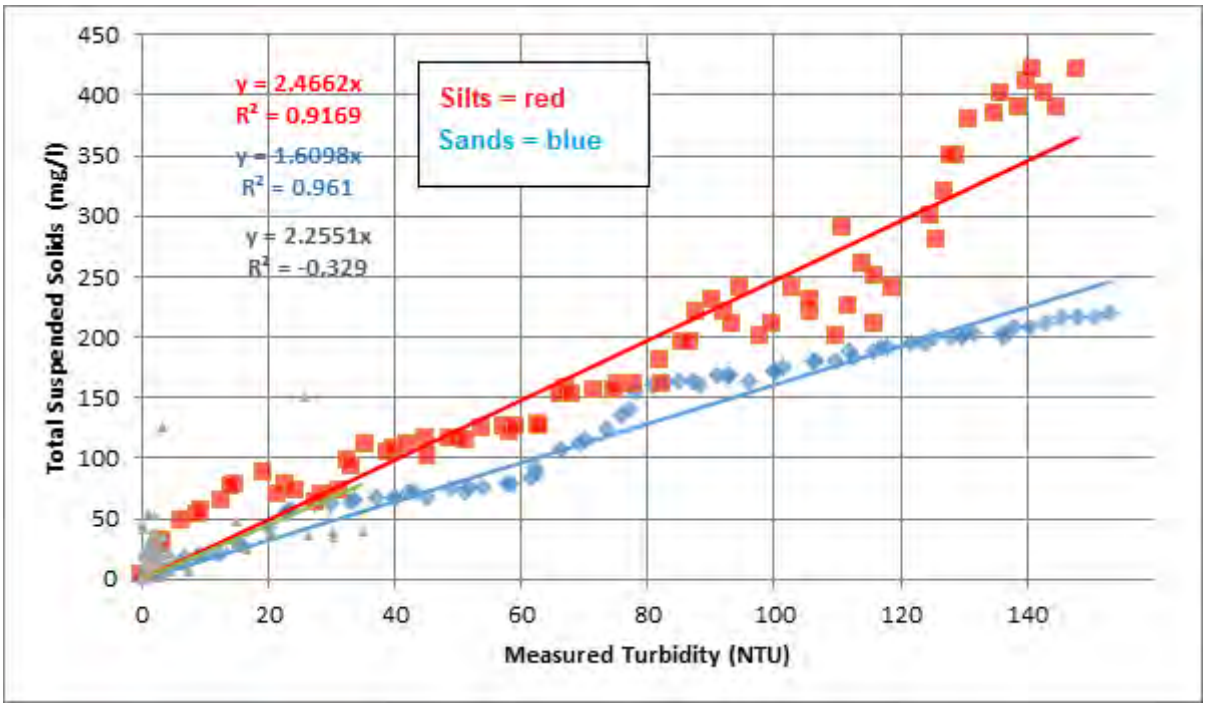


Figure 3.1: Relationship between TSS and NTUs for sand and silt dominated seawater within the Inner Liffey Channel and Dublin Bay (RPS, 2018)

3.1 Measuring Turbidity

Hydromaster utilised a vessel equipped with two turbidity monitors to track sediment plumes arising from the dumping of dredged spoil from the inner Liffey channel.

The survey vessel tracked back and forth across the plume until the turbidity monitors indicated background levels. This enabled the vessel to record spatial and temporally varying data across the plume envelope and produce turbidity tracks similar to the one presented in Figure 3.2 overleaf. The colour scale represents a “heatmap” with highest turbidity values (plume) shown by red and lowest turbidity values shown by blue.

Turbidity data was recorded at the surface and mid-point of the water column for most of the events summarised in Table 3.1 except for event 254 during which an instrumentation failure meant data could only be recorded at the mid-point. No mid layer data was recorded for events 281 and 285 due to a similar issue. Using this approach it was possible to produce plots to show the range of turbidity values between the surface and mid-points of the water column as shown in Figure 3.3.

It is important to note that each data point within this plot represents a turbidity measurement at a different location and at a different moment of time. The data is however very useful in showing the movement and rate of dispersion of the sediment plume.

This data was supported by turbidity measurements recorded at four fixed monitoring buoy locations as shown in Figure 3.4 where turbidity was recorded close to the surface, at mid-depth and close to the seabed.

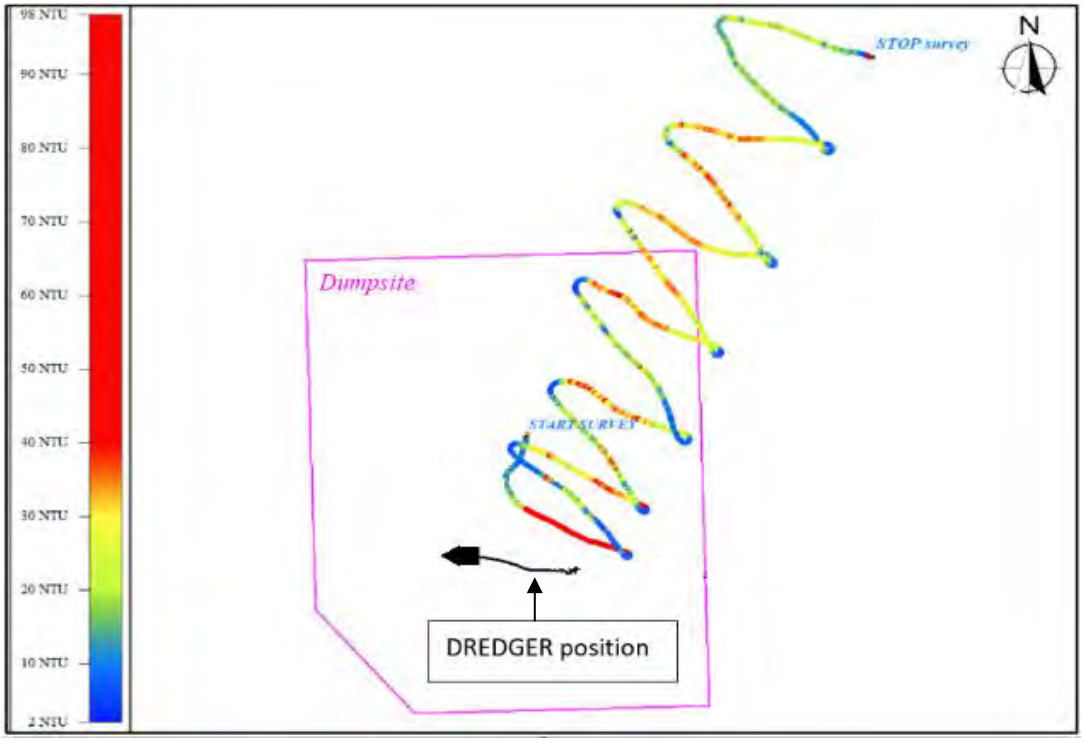


Figure 3.2: Example of a plume survey track with turbidity displayed as NTUs

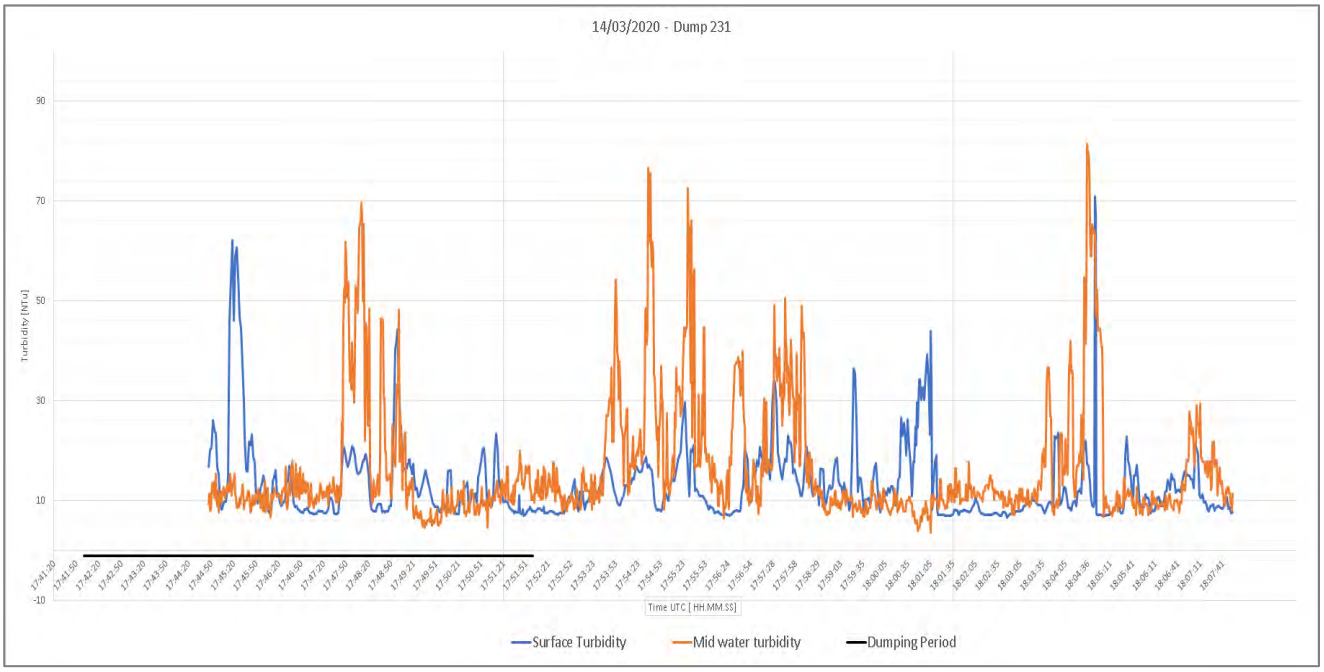


Figure 3.3: Example turbidity readings at the surface and mid-point of the water column during Dump Trip 231

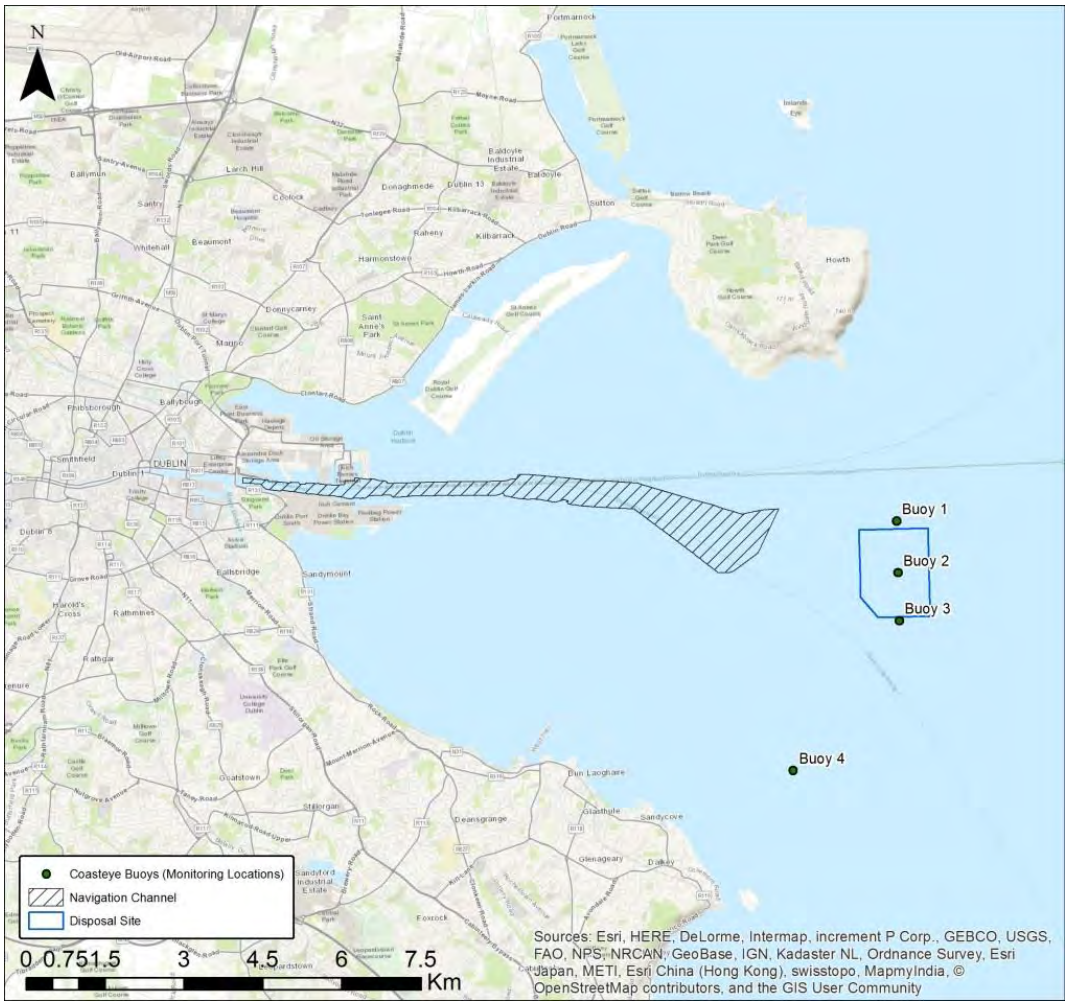


Figure 3-4: Locations of the Monitoring Buoys at the Dump Site

4 COMPUTATIONAL MODELS

4.1 Modelling Overview

RPS used the MIKE 21 hydrodynamic numerical modelling software package developed by DHI, to undertake the sediment plume simulations presented in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application. The same models were used in the model validation process.

The MIKE system is a state of the art, industry standard, modelling system, based on a flexible mesh approach. This software was developed for applications within oceanographic, coastal and estuarine environments.

A brief synopsis of the MIKE system and modules used for this assessment is outlined below:

- **MIKE 21 FM system -** Using this flexible mesh modelling system, it was possible to simulate the mutual interaction between currents, waves and sediment transport by dynamically coupling the relevant modules in two dimensions.
  - **The Hydrodynamic (HD) module -** This module is capable of simulating water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The HD Module is the basic computational component of the MIKE 21 Model system providing the hydrodynamic basis for the Sediment Transport and Spectral Wave modules. The Hydrodynamic module solves the two-dimensional incompressible Reynolds averaged Navier-Stokes equations subject to the assumptions of Boussinesq and of hydrostatic pressure. Thus the module consists of continuity, momentum, temperature, salinity and density equations. In the horizontal domain both Cartesian and spherical coordinates can be used.
  - **The Sediment Transport module** - The Sediment Transport Module simulates the erosion, transport, settling and deposition of cohesive sediment in marine and estuarine environments and includes key physical processes such as forcing by waves, flocculation and sliding. The module can be used to assess the impact of marine developments on erosion and sedimentation patterns by including common structures such as jetties, piles or dikes. Point sources can also be introduced to represent localised increases in current flows as a result of outfalls or ship movements etc.

4.2 Computational Models and Data Sources

RPS' model of Dublin Bay was created using flexible mesh technology to provide detailed information on the coastal processes around the licenced dump site and Dublin Port as well as the wider Dublin Bay area. The model uses mesh sizes varying from 250,000m^2 (equivalent to 500m x 500m squares) at the outer boundary of the model down to a very fine 225 m^2 (equivalent to 15m x 15m squares) in Dublin Port and around the licenced dump site. The extent, mesh structure and bathymetry of this model is presented in Figure 4.1.

The bathymetry of this model was developed using data gathered from hydrographic surveys of Dublin Port, the Tolka estuary and the dump site since 2017 to present. This resource was supplemented by data from the Irish National Seabed Survey, INFOMAR and other local surveys collated by RPS for the Irish Coastal Protection Strategy Study (RPS, 2003).

Tidal boundaries for the Dublin Bay model shown in Figure 4.1 were taken from the Irish Coastal Protection Strategy Study (ICPSS) tidal surge mode. This mode was developed using flexible mesh technology with the mesh size varying from *c.* 24km along the offshore Atlantic boundary to *c.* 200m around the Irish coastline. This validated model is run three times daily on behalf of the Office of Public Works (OPW) to provide detailed tidal information around the coast of Ireland. The extent and bathymetry of this model is illustrated in Figure 4.2

Boundary conditions used to represent the mean annual river flows for the Liffey, Dodder and Tolka were set at 15.6, 2.3 and 1.4m^3/s respectively.

It should that the same computational models used to support the environmental assessment of the Alexandra Basin Redevelopment project (RPS, 2014) were used for this technical assessment. A previous calibration and validation exercise that utilised recorded data from throughout Dublin Bay concluded that the Dublin Bay model performed very well and provided a very good representation of the coastal processes in the Dublin Port and Dublin Bay.

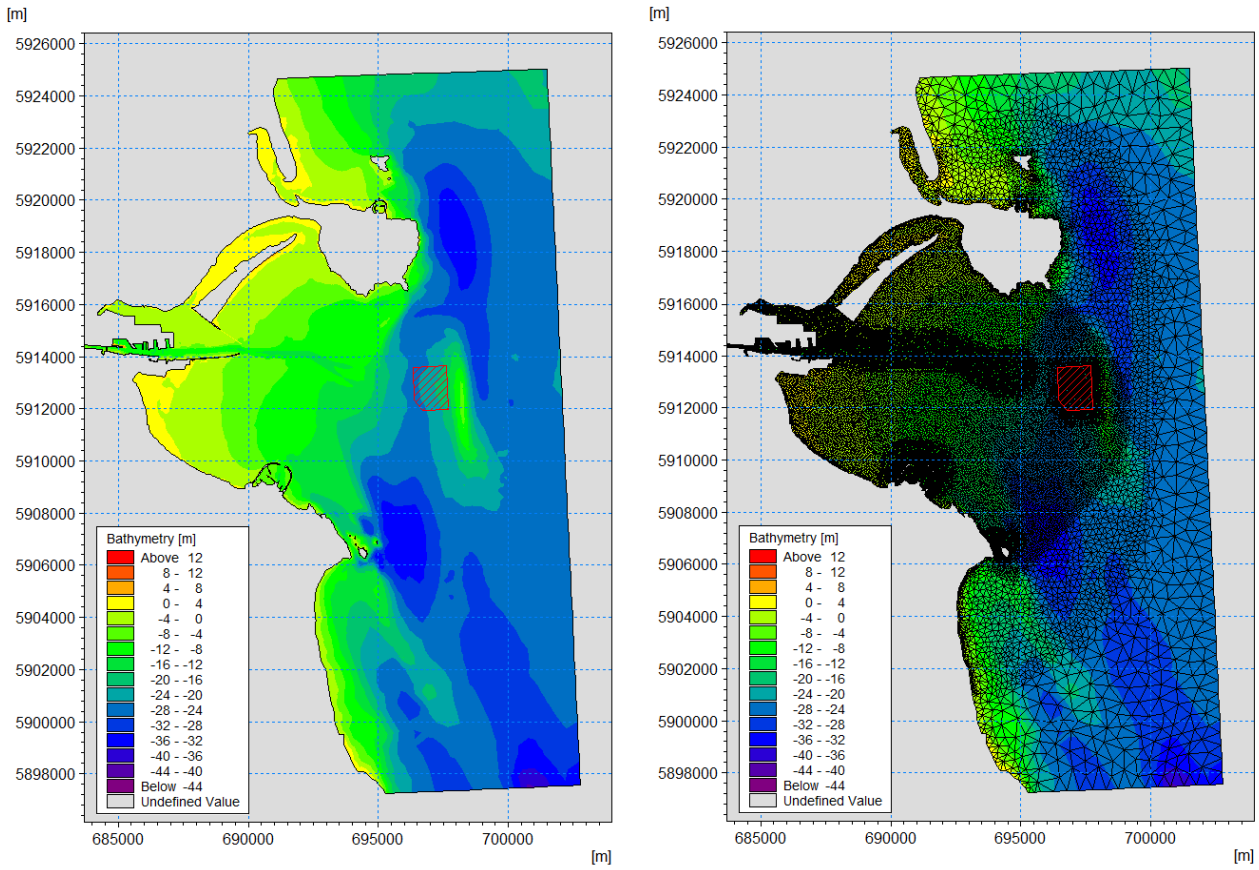


Figure 4.1: Extent and bathymetry (left) and mesh structure (right) of the Dublin Bay model. Location of the licenced dump site shown by red hatch area.

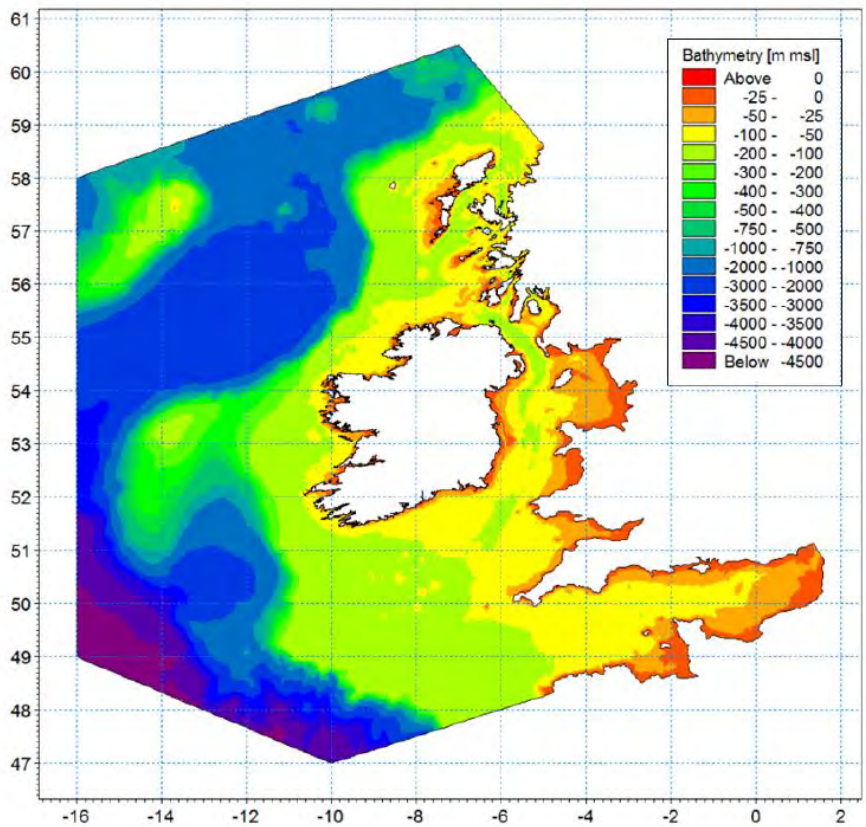


Figure 4.2: Extent and bathymetry of Irish Seas Tidal and Storm Surge model

4.3 Characterisation of Dumping Material

Simulations were undertaken to determine the concentration and distribution of sediment lost to the water column during the dumping events at the licenced offshore dump site. As described in the following Section, the sediment material was first characterised by a number of different mixtures with different sand and silt fractions. Upon identification of the most suitable mixture type and composition, these parameters were used to simulation all 210 dredging trip undertaken in March 2020. It should be noted that all dumping events were assessed using a single simulation so that sediment plumes from previous dumping events were fully accounted for.

The coupled MIKE 21 sediment transport model was used to simulate the fate of the silt released from the barges over the dump site by moving a sediment source along the track that the barge would take as it transversed the dump site area during the disposal operation. The model then simulated the dispersion, settlement and re-erosion of each fraction of the dredged material in response to the tidal currents throughout the model area.

The spill rate and the dump co-ordinates for each dumping event was specified using information from detailed dredge logs provided by the dredging contractor. Given the duration of the dredging and disposal campaign, simulations were run for using a range of spring and neap tidal conditions. These models also included for the effect of wind driven currents.

An example of the dredge track used to specify the location of the sediment source in the models is presented in Figure 4.3 below.

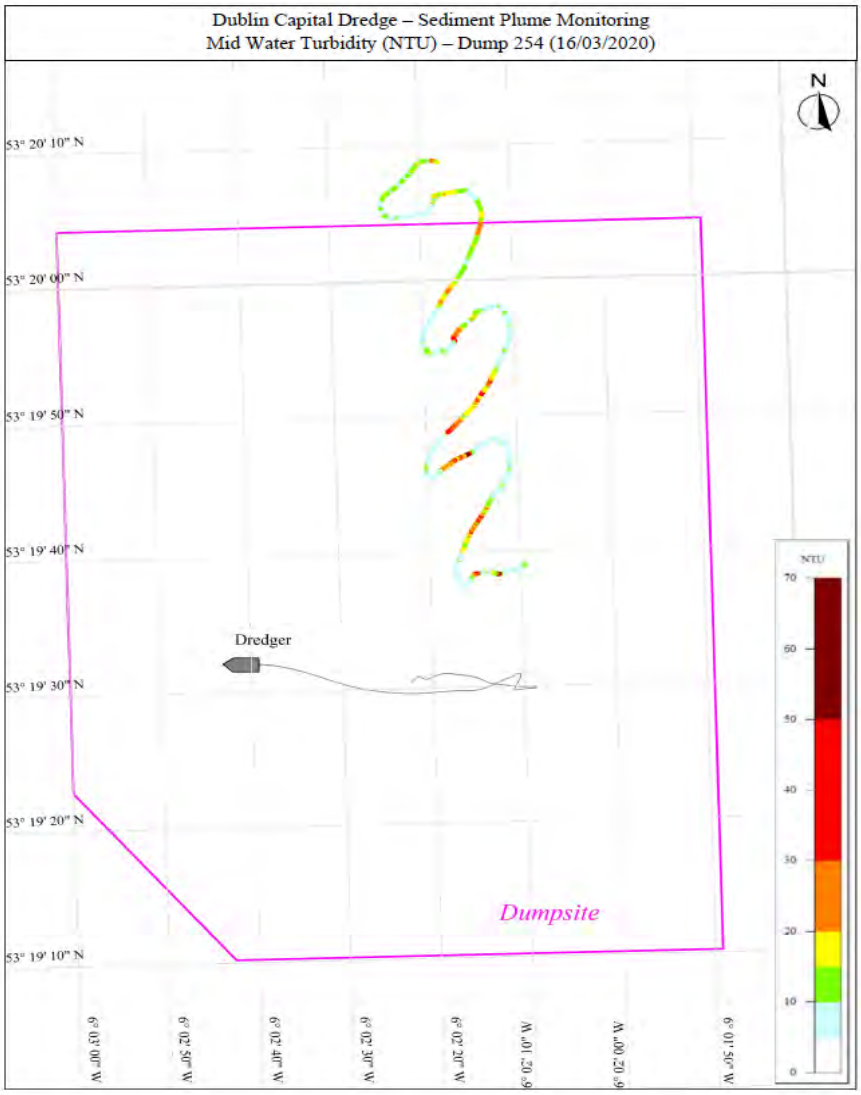


Figure 4.3: Example of the dredge track used to specify the coordinates of the sediment source in the numerical model runs

5 REVIEW OF PARAMETERS USED FOR THE ABR ENVIRONMENTAL ASSESSMENT

The numerical modelling work undertaken in support of the Alexandra Basin Redevelopment (ABR) Project (RPS, 2014) specified sediment material as being characterised by three discrete fractions with mean diameters of 200µm, 20µm and 3µm with each fraction constituting 1/3 of the total volume dredge material (Mixture 1 in Figure 5.1 below). This specification was based on Particle Size Distributions (PSDs) of sediment samples collected from the Harbour area (RPS, 2014).

In order to validate this parameter RPS ran a series of sediment plume models for dump event 231 using a range of different sediment material characteristics. Dump event 231 was chosen for this analyses as it was the first event that Hydromaster collected detailed survey data for. The four different mixture types used for this assessment are summarised in Figure 5.1 and were comprised of various fine sand to fine silt fractions.

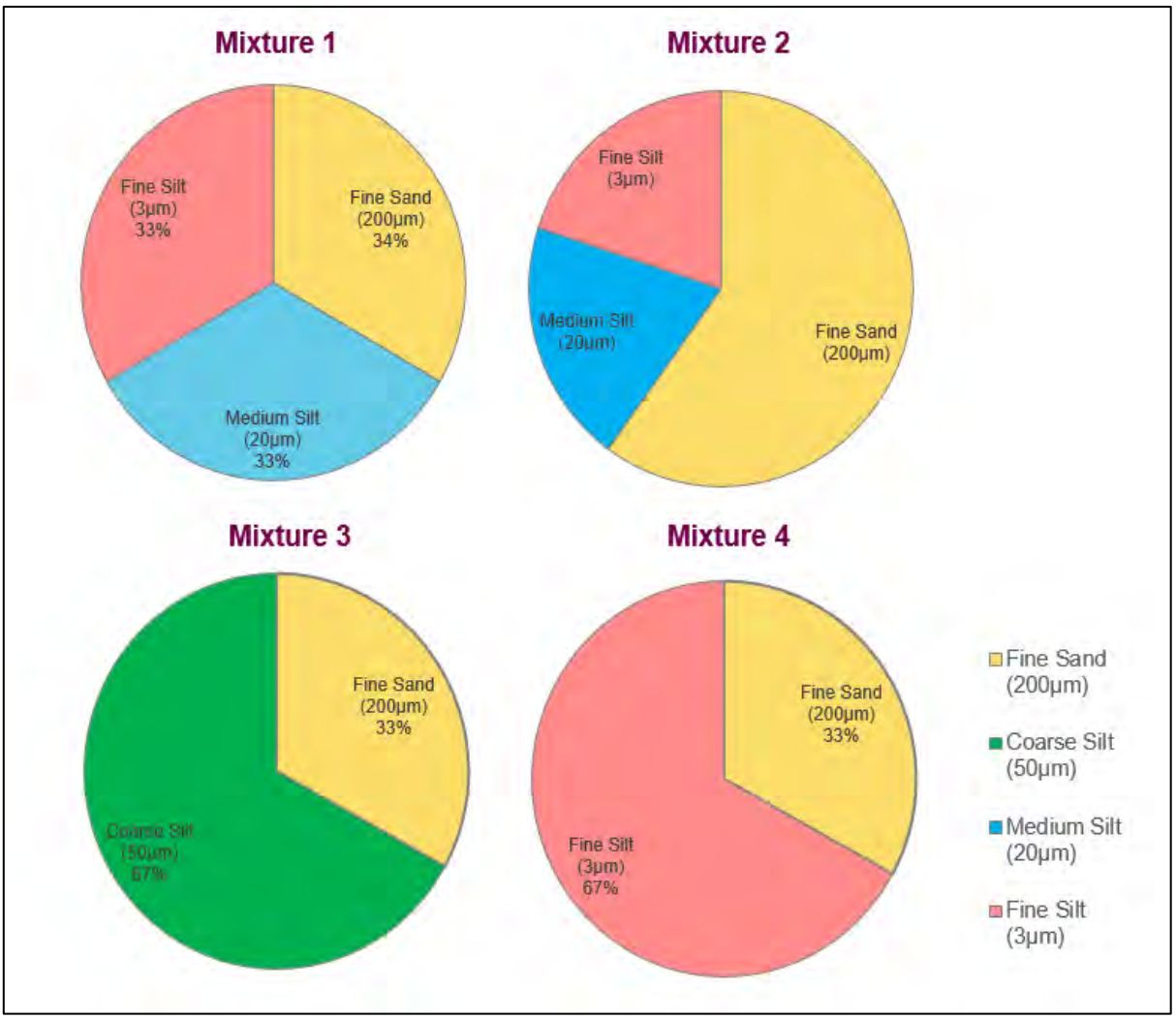


Figure 5.1: Composition of sediment mixtures used to represent the dredge material dumped at the dump site

The output from these simulations are presented in Figure 5.2 to Figure 5.5 for Mixtures 1 – 4 respectively. As demonstrated by these plots, the sediment plumes generated by these mixtures correspond well to recorded data. However, as summarised in Table 5.1 Mixture 1 was found to agree best with recorded turbidity levels with simulated turbidity levels falling within the recorded surface and mid-point measurements 79% of the time.

Based on this information it can be concluded that the sediment was specified correctly in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application. All subsequent model simulations in this study were therefore undertaken using sediment parameters reflective of mixture 1.

Table 5.1: Summary of sediment mixtures and % agreement with actual turbidity levels recorded during dump event 231

Sediment	Composition [%]			
	Mixture 1	Mixture 2	Mixture 3	Mixture 4
Fine Sand (200µm)	33	60	33	33
Coarse Silt (50µm)	n/a	n/a	67	n/a
Medium Silt (20µm)	33	20	n/a	n/a
Fine Silt (3µm)	33	20	n/a	67
Agreement with recorded Turbidity levels during event 231 [%]	79.22	61.66	63.15	68.47

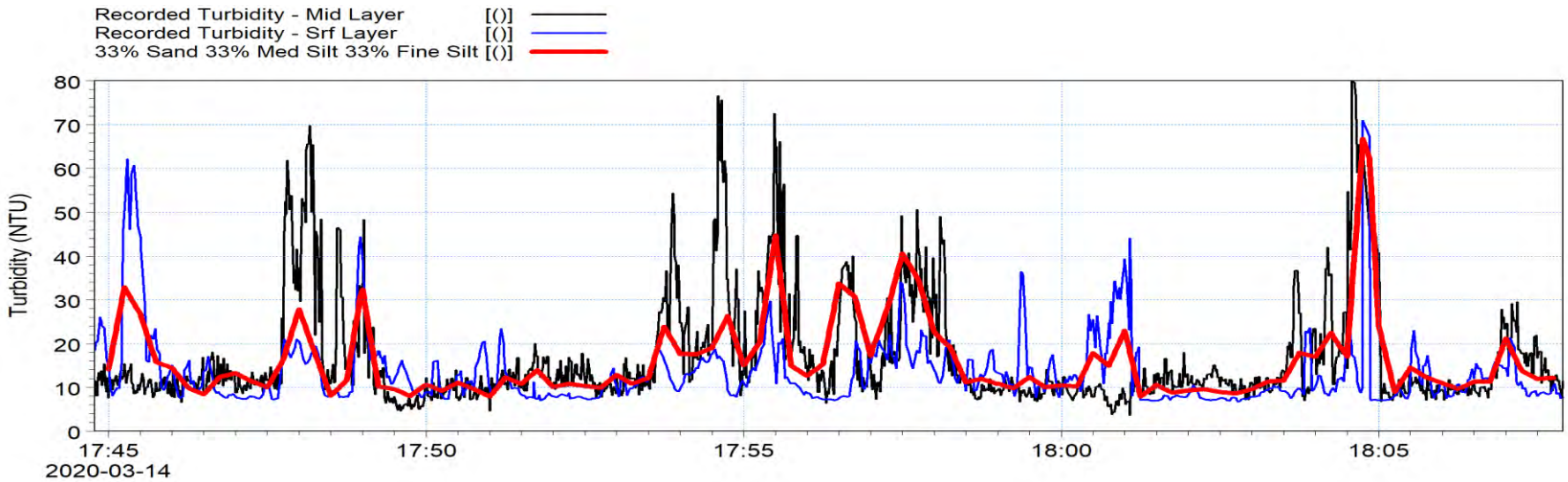


Figure 5.2: Comparison of recorded and simulated turbidity levels during dump event 231 – Mixture 1 (33% fine sand; 33% medium silt; 33% fine silt)

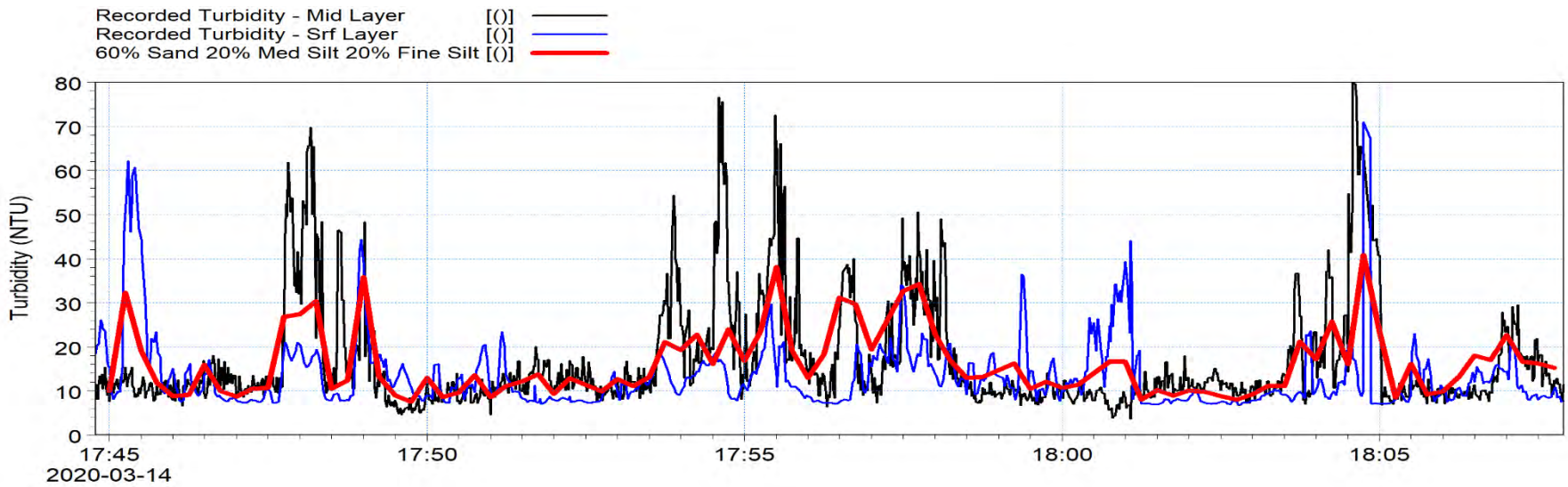


Figure 5.3: Comparison of recorded and simulated turbidity levels during dump event 231 – Mixture 2 (60% fine sand; 20% medium silt; 20% fine silt)

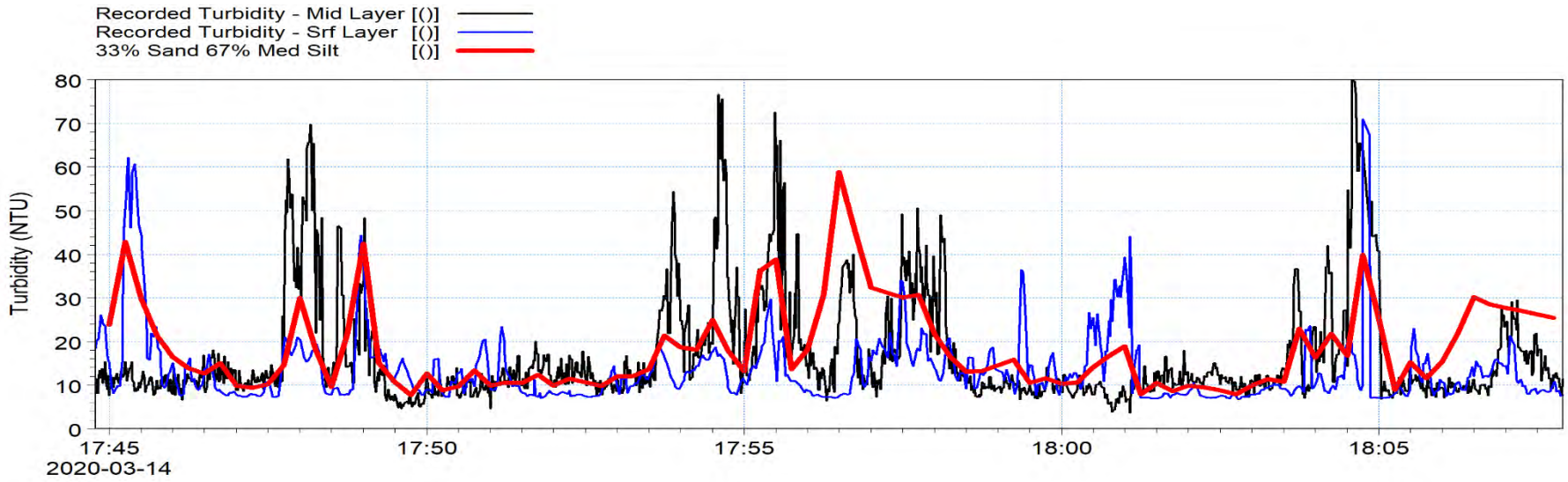


Figure 5.4: Comparison of recorded and simulated turbidity levels during dump event 231 – Mixture 3 (33% fine sand; 67% medium silt)

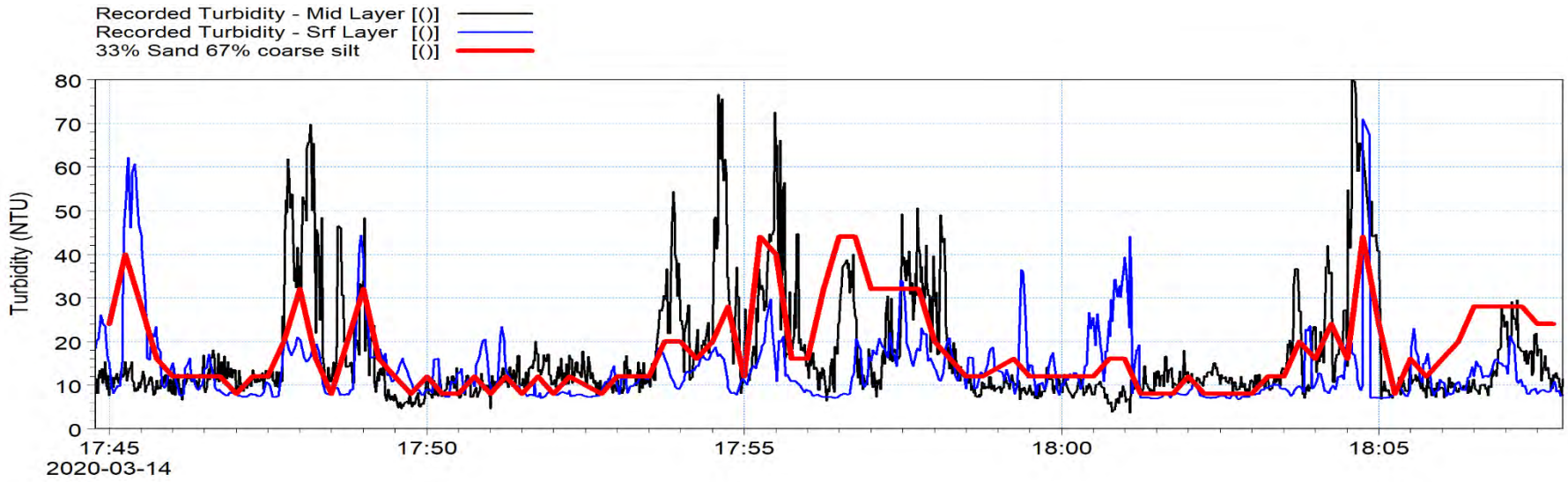


Figure 5.5: Comparison of recorded and simulated turbidity levels during dump event 231 – Mixture 4 (33% fine sand; 67% coarse silt)

6 OUTPUT FROM SEDIMENT PLUME MODELLING

Having determined suitable specifications for the sediment material (see Section 5), RPS produced a series of figures that compares simulated and recorded turbidity levels at the Dump Site.

- To determine the spatial accuracy of the model used, each figure illustrates the extent and concentration of the sediment plume for one time-step relative to the recorded survey tracks.
- The temporal accuracy of the model is demonstrated by time series plots that compare 2D depth averaged simulated turbidity concentration levels with recorded data. These plots remove the spatial element of the data so that a direct comparison of concentrations can be easily made.

As it was not practical to produce a sediment plume plot for every time-step and dump event, RPS instead provided time-series plots for each dump event for which there was suitable data (see Table 3.1 in Section 3).

In total, this equated to 12 individual events across a range of typical spring and neap tidal conditions. Environmental conditions were also varying with dumping events regularly occurring during windy spells with notable wave action from different directions. The results which are presented in Appendix A demonstrate that the computational models accurately simulate the temporal and spatial dispersion of sediment plumes during the dumping activities to a very high degree of accuracy.

6.1 Sediment Plume Envelopes

RPS has produced sediment plume plots for a number of representative dump events presented in Table 6.1 below.

The ***spatial accuracy*** of the numerical model is demonstrated by comparing the spatial extent of the simulated sediment plumes illustrated in the 2D plots and survey tracks in Figure 6.1 to Figure 6.8**.** It will be seen that the general plume envelope size and direction of transport is very similar to the corresponding survey track.

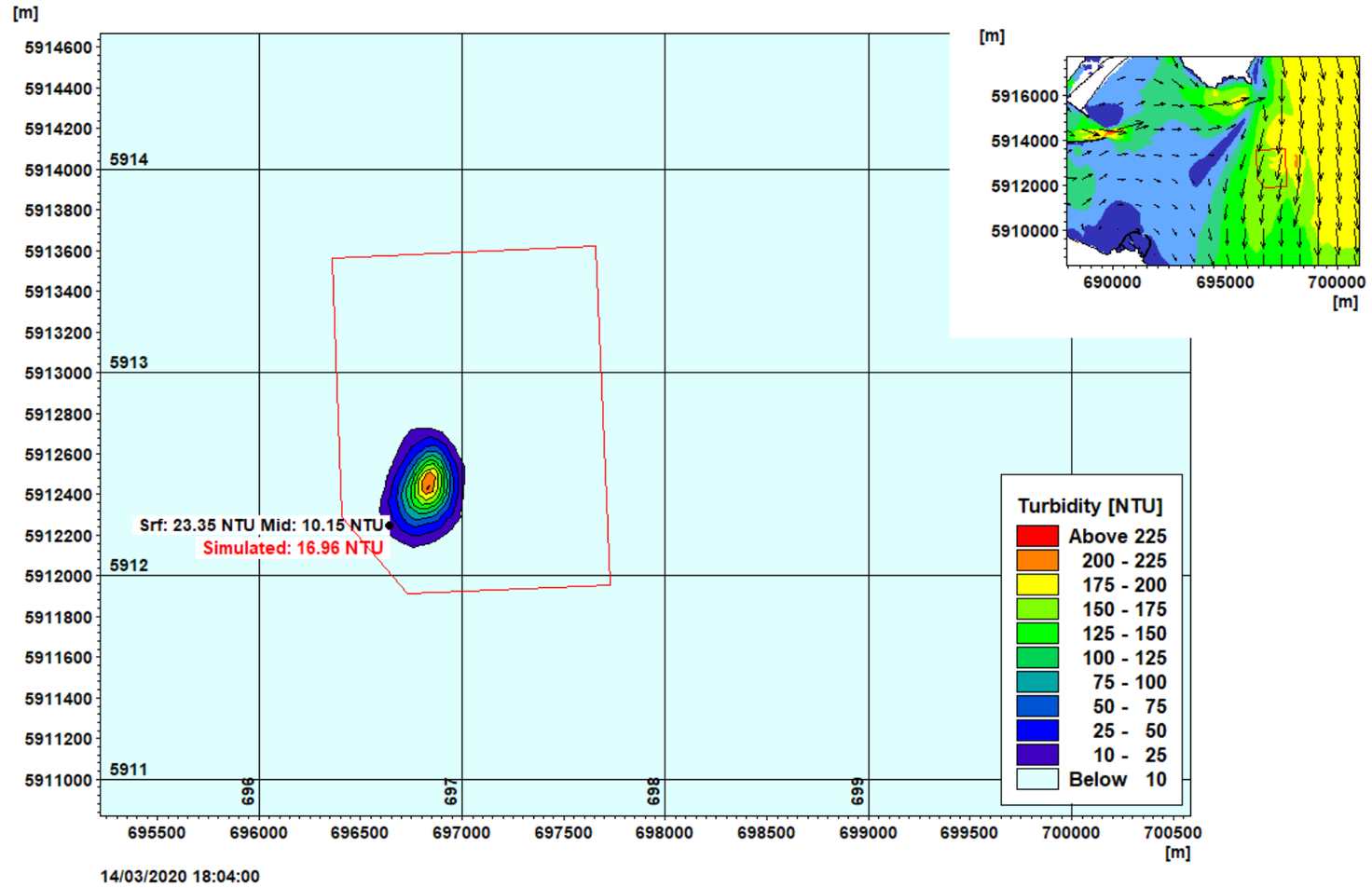
A comprehensive demonstration of the ***temporal accuracy*** of the numerical models is provided by means of time-series plots that compare simulated and recorded data in Figure 6.1 to Figure 6.8**.** These plots show that the 2D depth averaged simulated turbidity concentration usually falls within the envelope of values recorded at the surface and mid water column points.

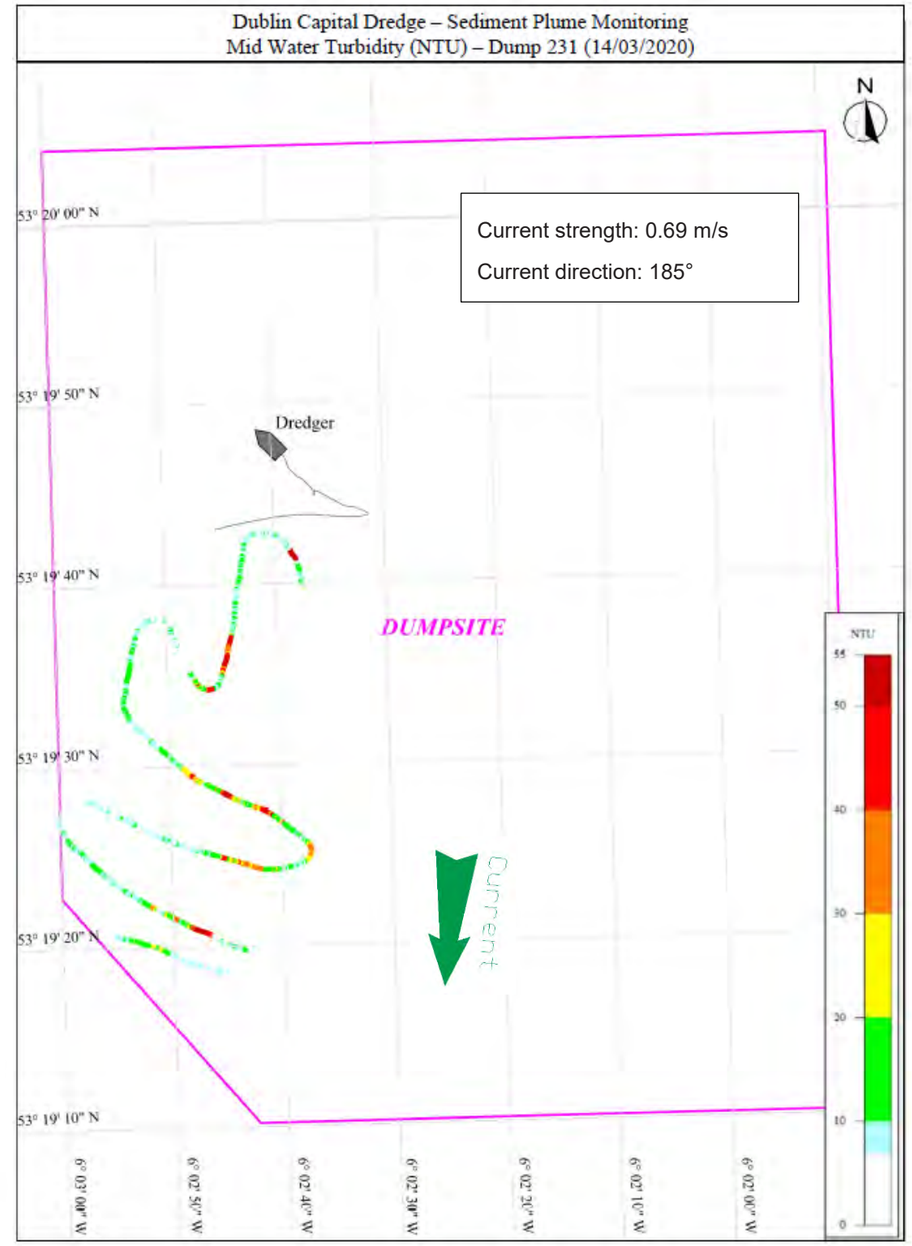
Importantly, the model accurately represents the dredge plumes from the time of initial release to the point whereby the sediment plume reduces to below background levels, i.e. becomes fully dispersed.

Table 6.1: Index of sediment plume plots across a range of typical tidal conditions

Tidal Phase	Dump #	Figure No.	Time after initial release
Mid-ebb	**231**	Figure 6.1	**19min**
Low water	**254**	Figure 6.2	**21min**
Mid-ebb	**266**	Figure 6.3	**6min**
Low Water	**267**	Figure 6.4	**15min**
Mid-flood	**268**	Figure 6.5	**30min**
Mid-ebb	**280**	Figure 6.6	**28min**
Mid ebb	**281**	Figure 6.7	**31min**
Mid-flood	**283**	Figure 6.8	**1hr 2min**

The numerical model utilised by RPS accurately simulates the dispersion of sediment across a range of tidal events and environmental conditions to a very high degree of accuracy. It can therefore be concluded that the model is well calibrated and fit for purpose.





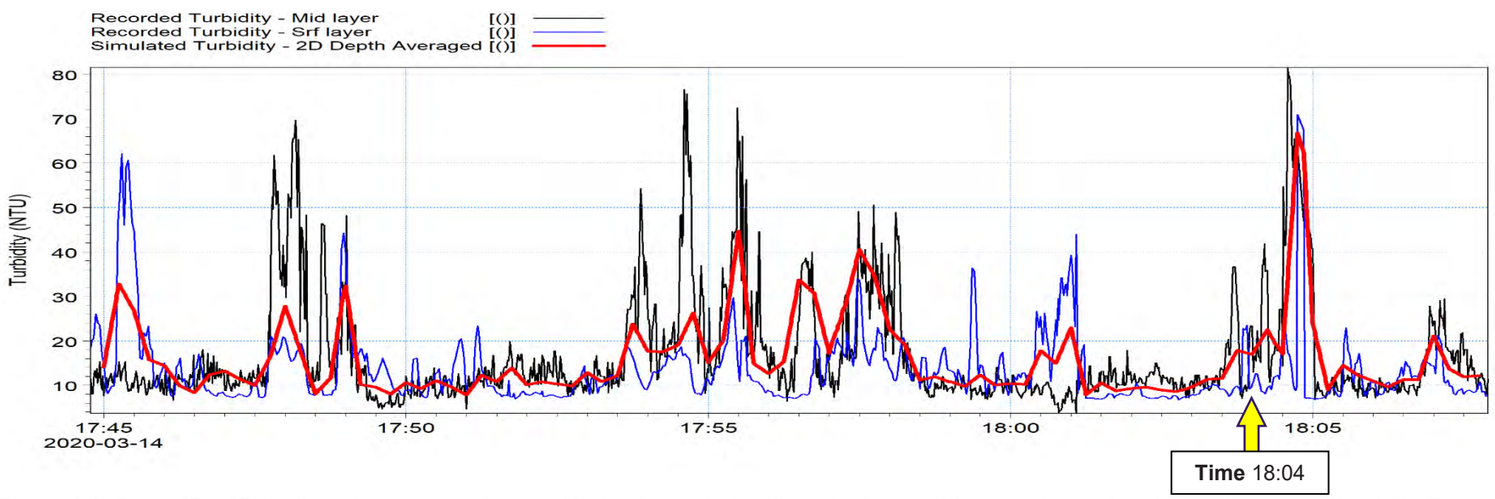
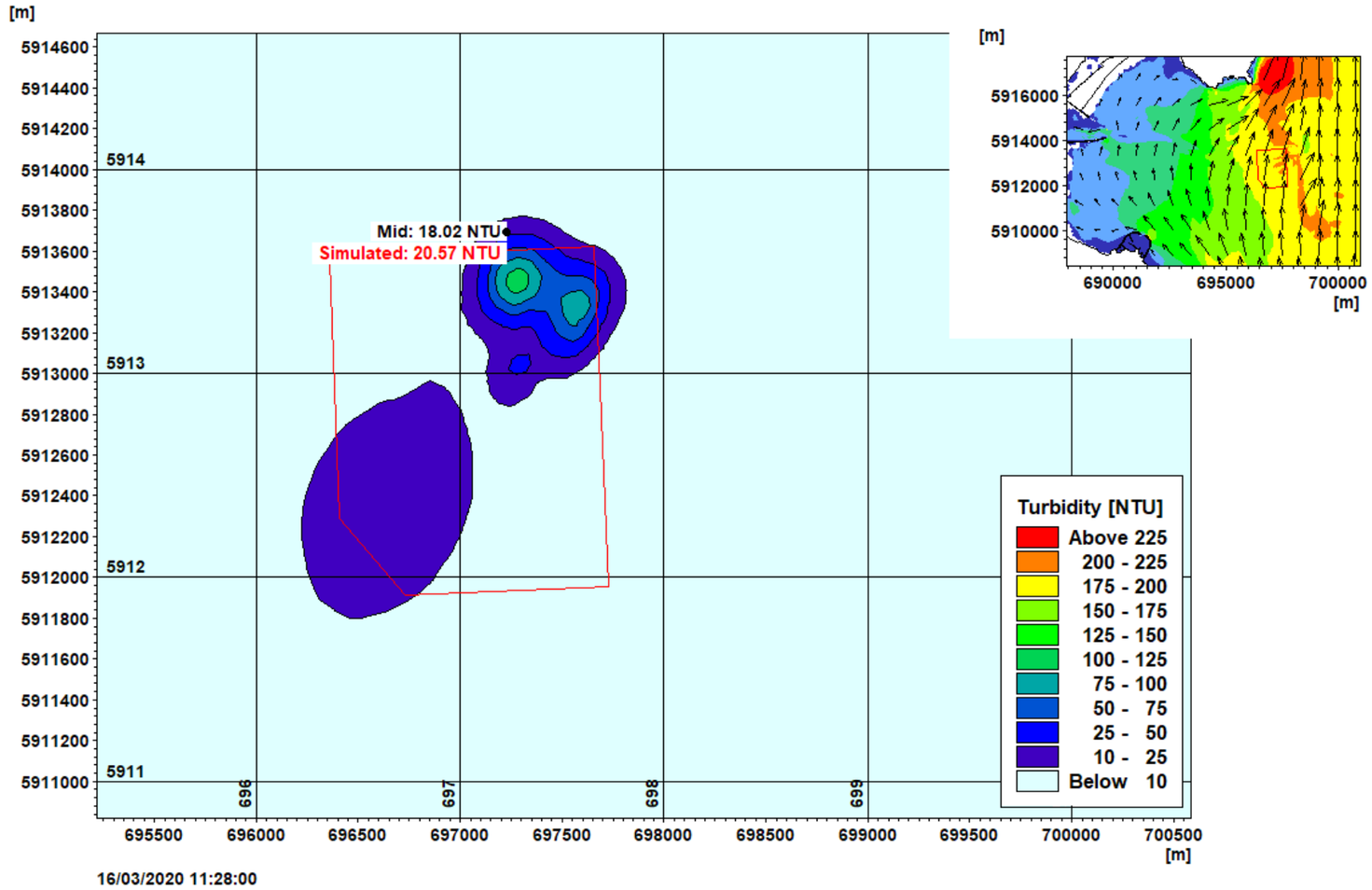
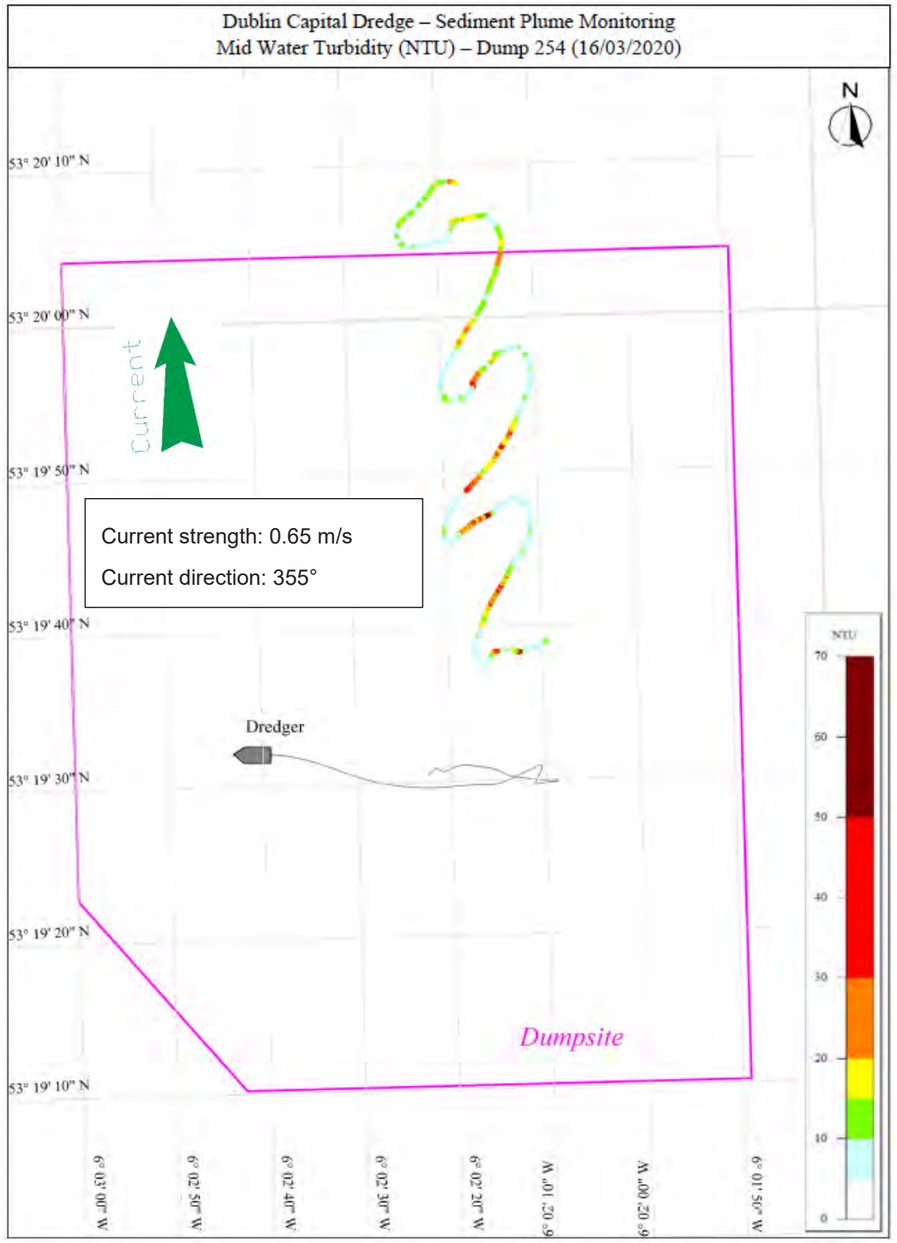


Figure 6.1: Event 231. 2D Sediment plume envelope *c.* 19min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)





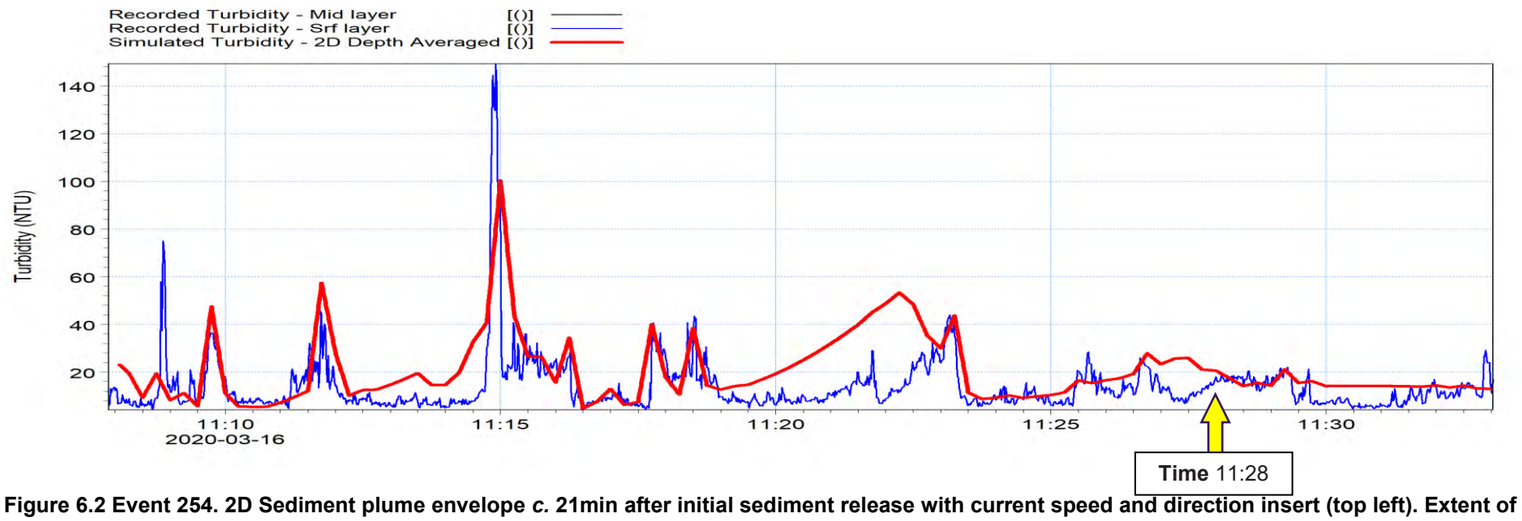
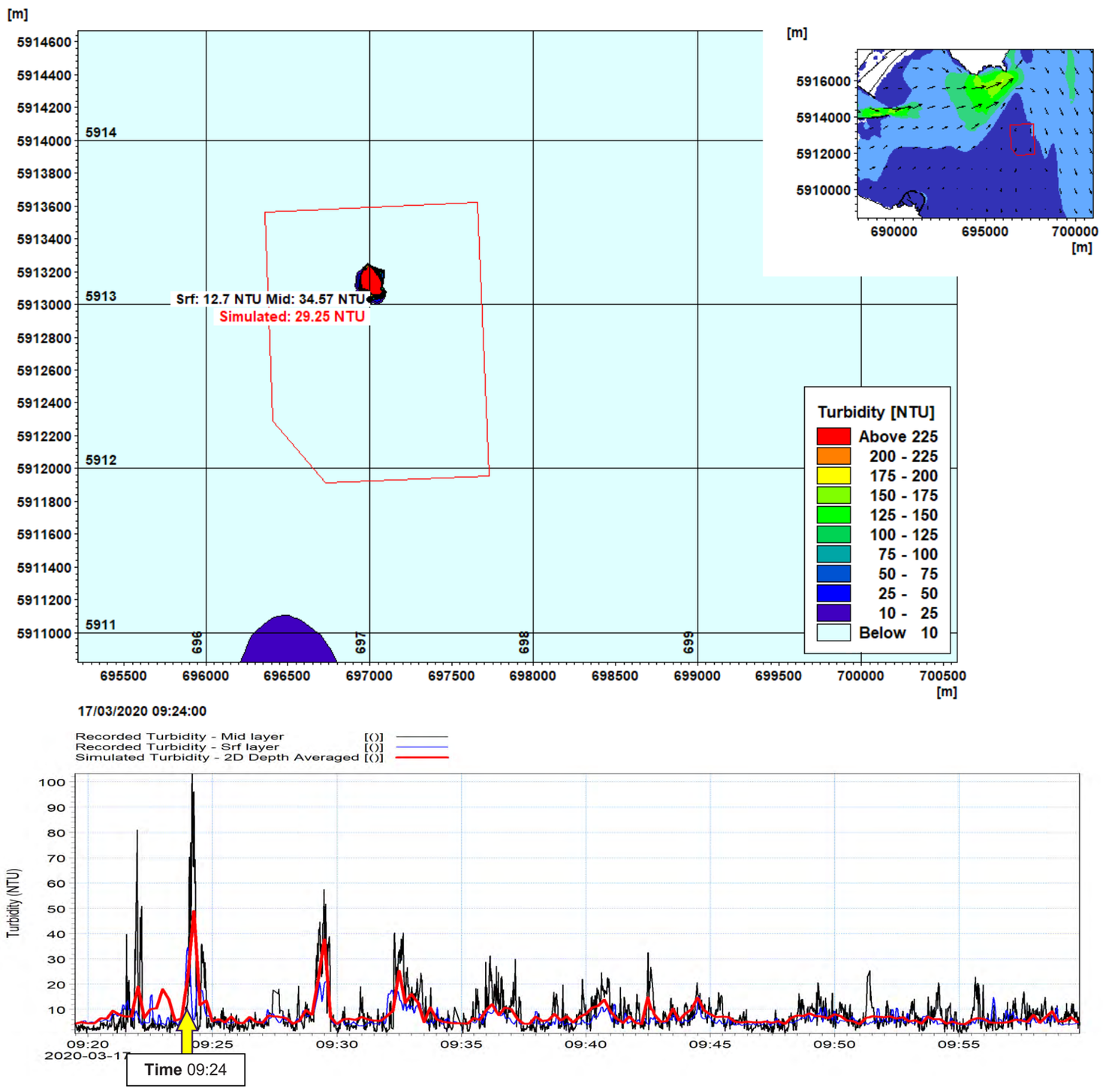


Figure 6.2 Event 254. 2D Sediment plume envelope *c.* 21min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)



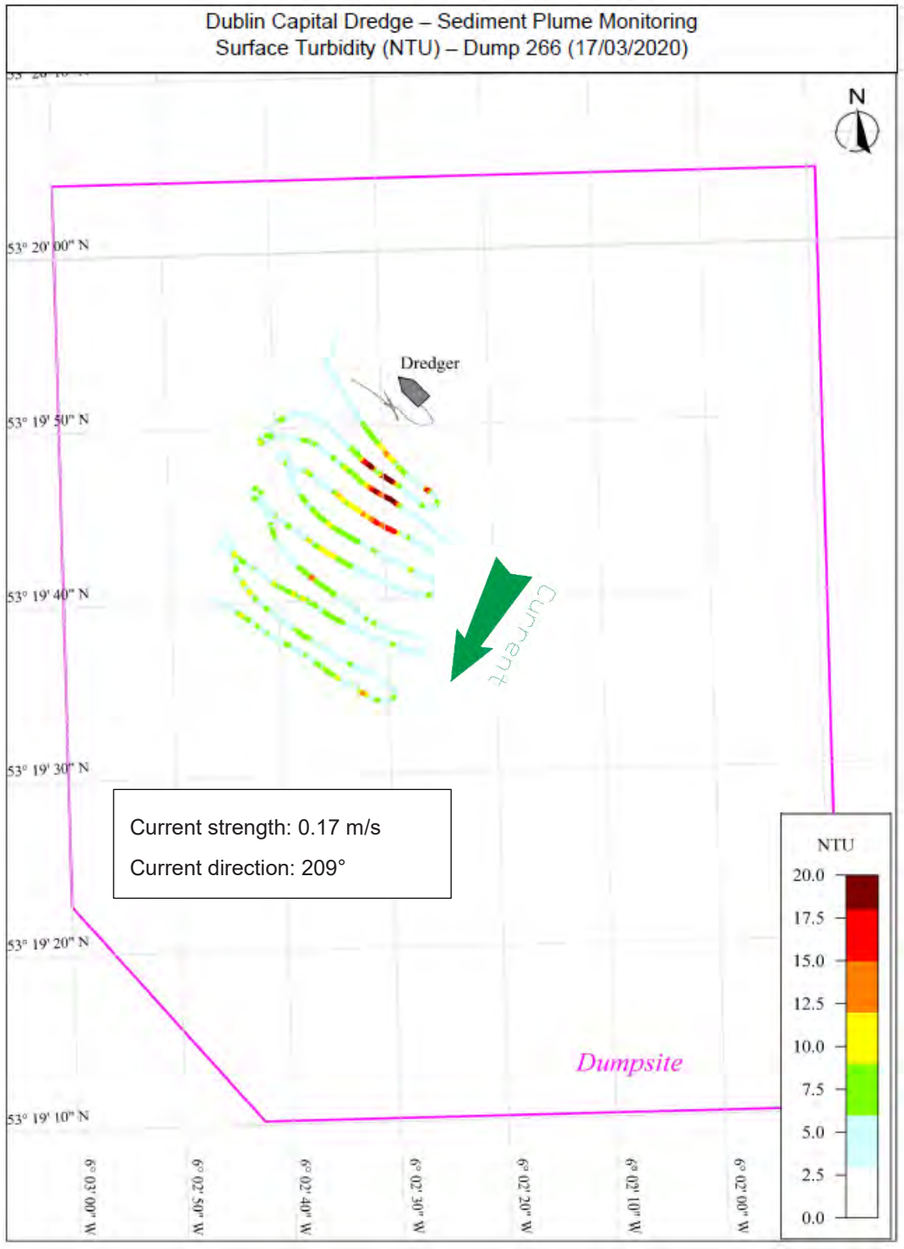
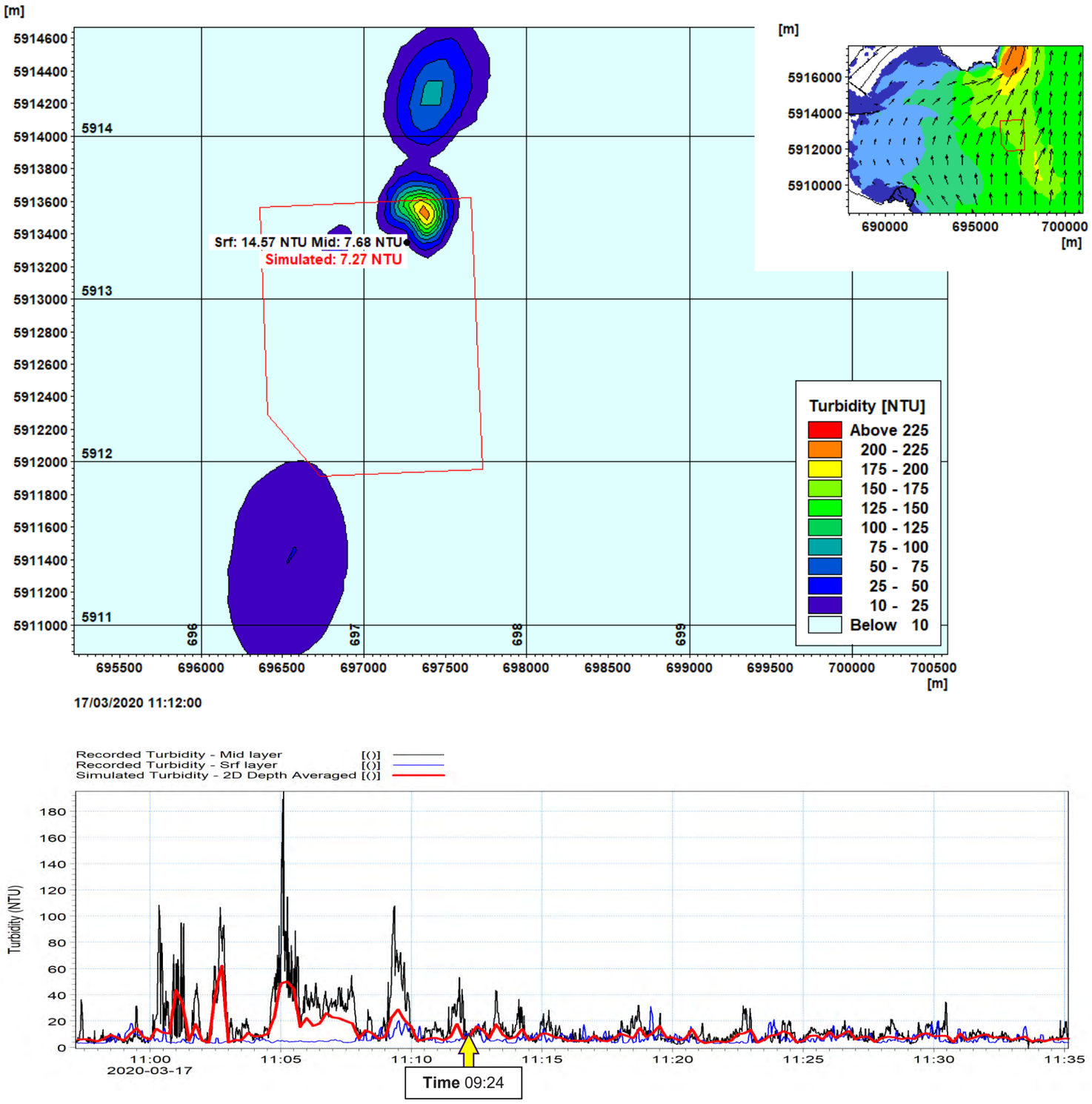


Figure 6.3 Event 266. 2D Sediment plume envelope *c.* 6min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)



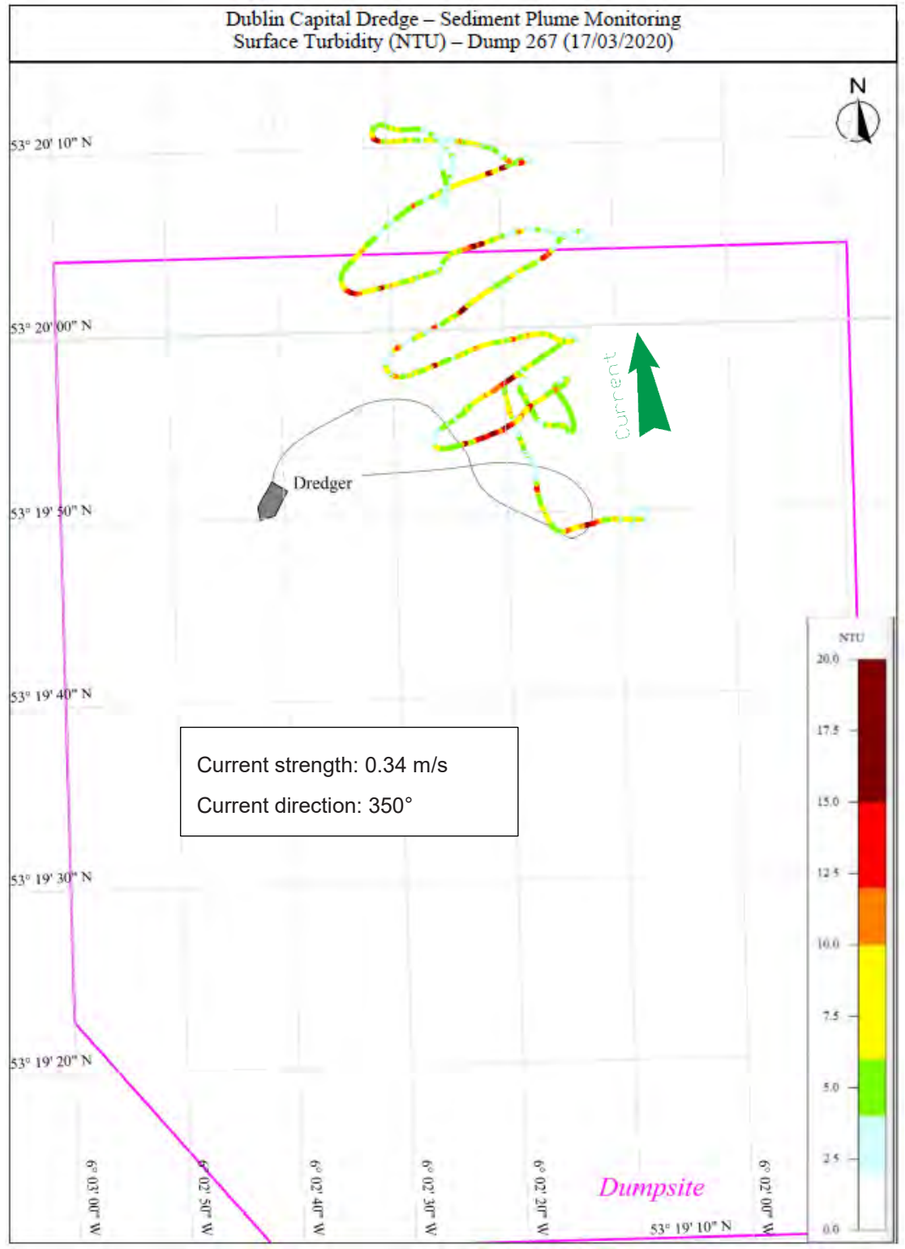
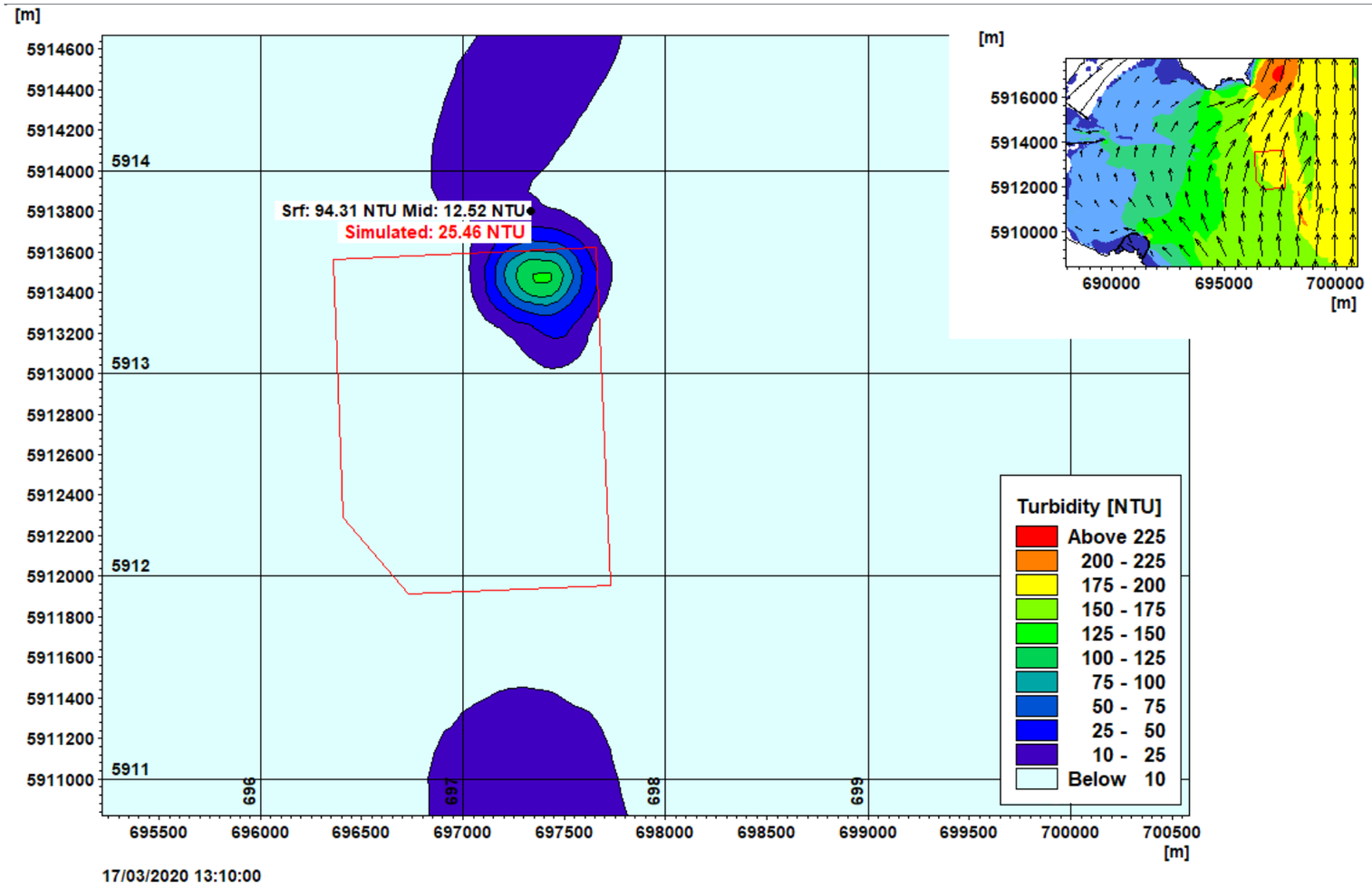
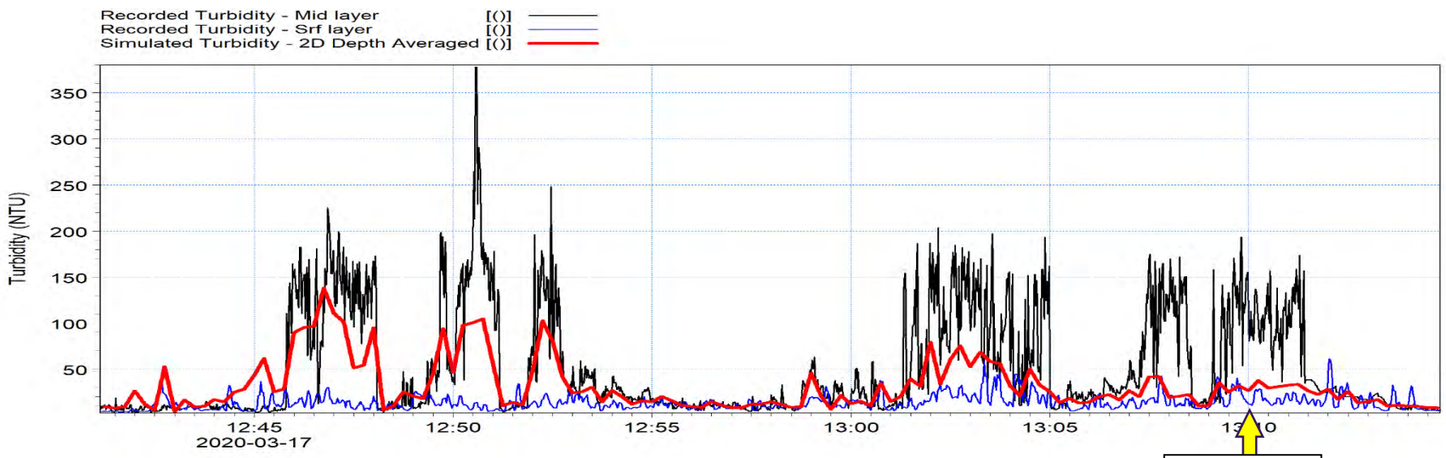


Figure 6.4 Event 267. 2D Sediment plume envelope *c.* 15min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)





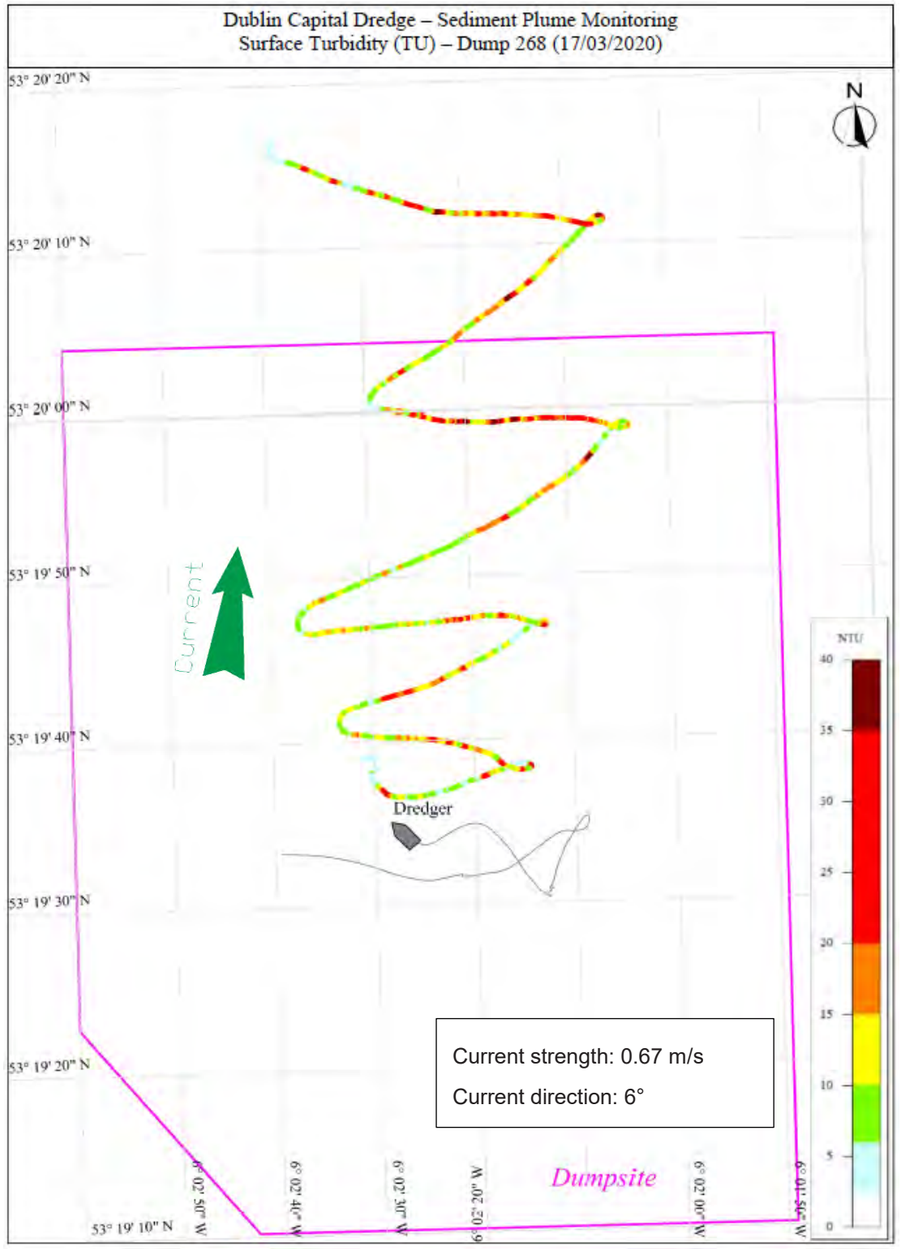


Figure 6.5 Event 268. 2D Sediment plume envelope *c.* 30min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)

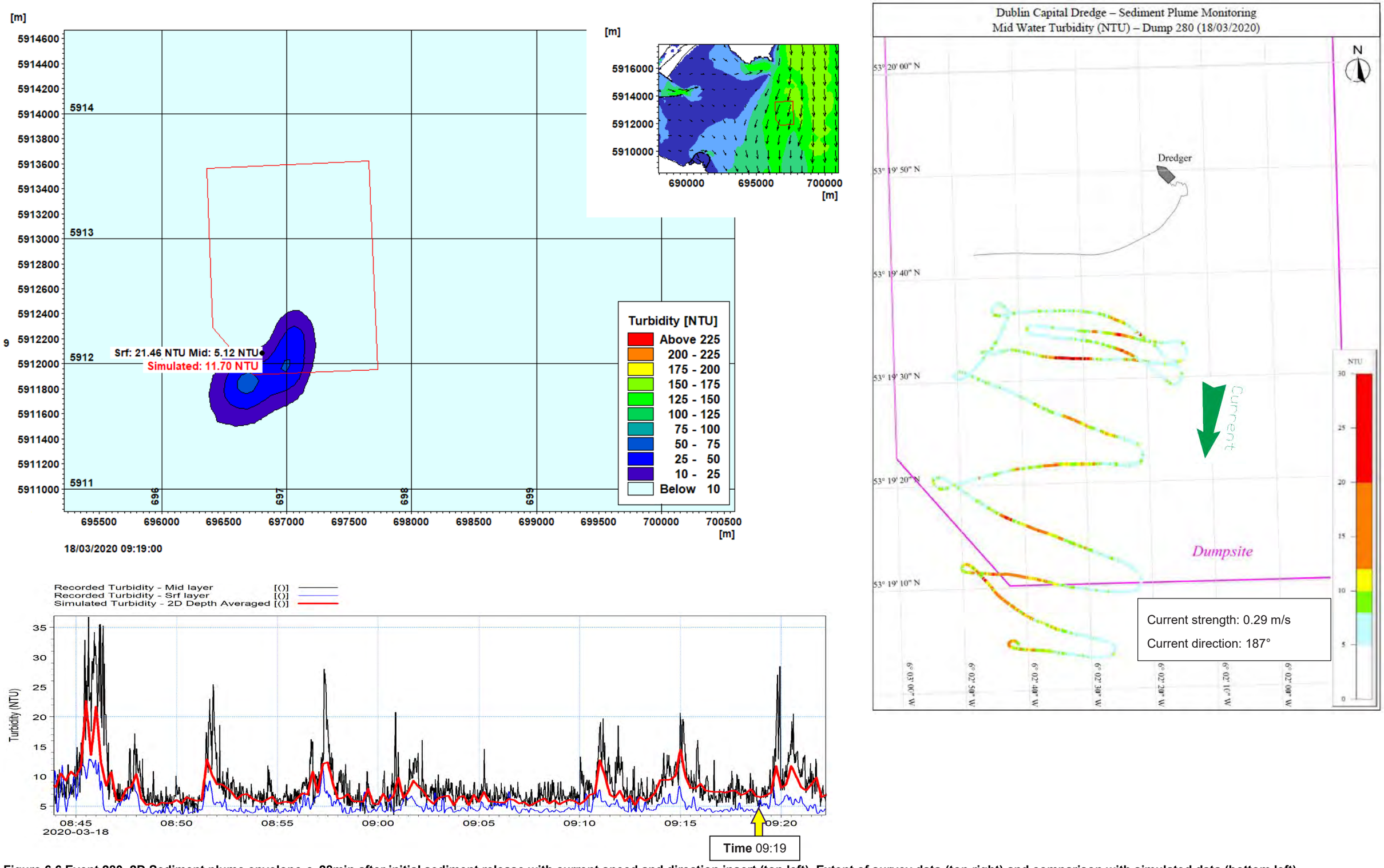
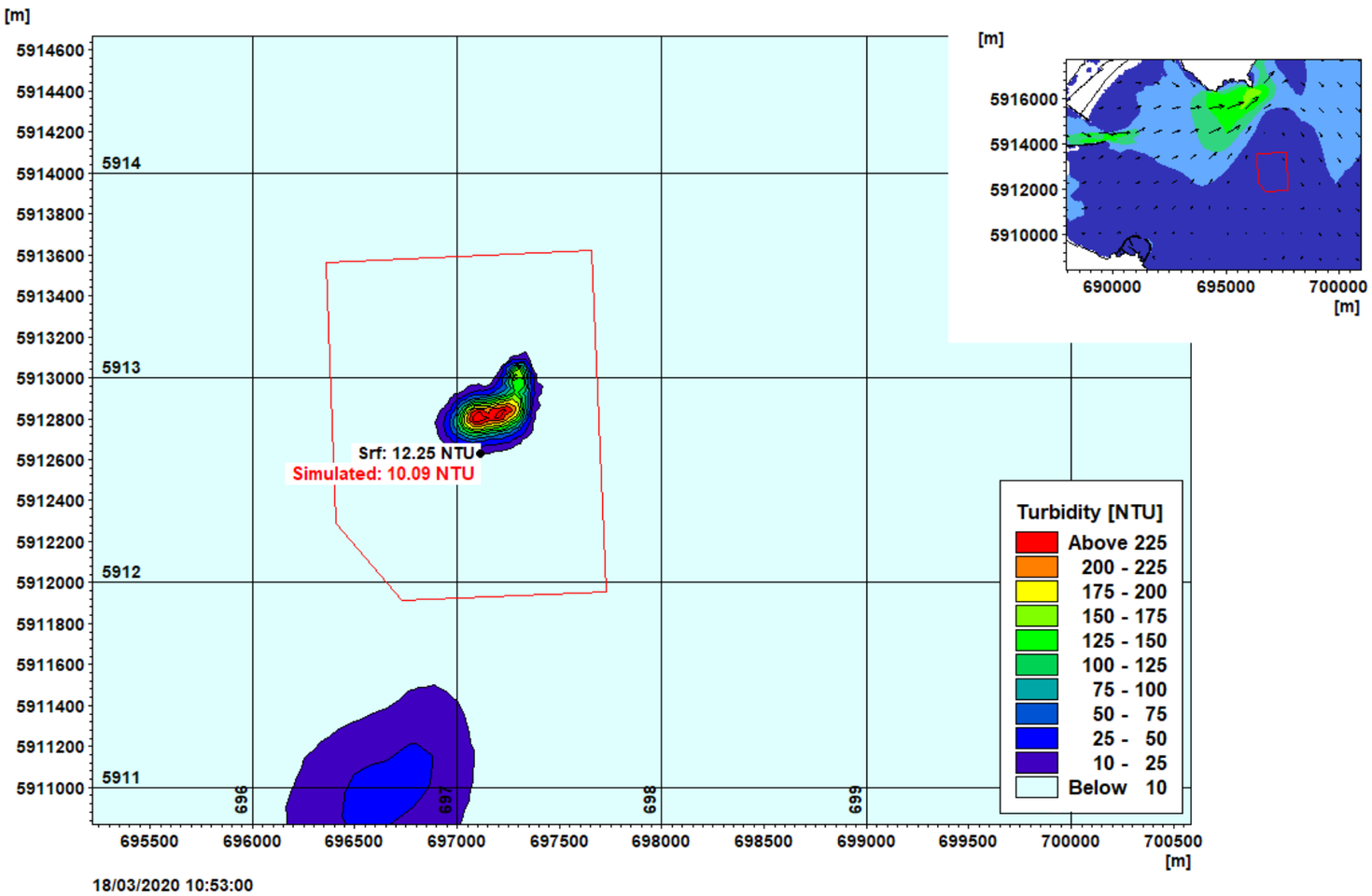
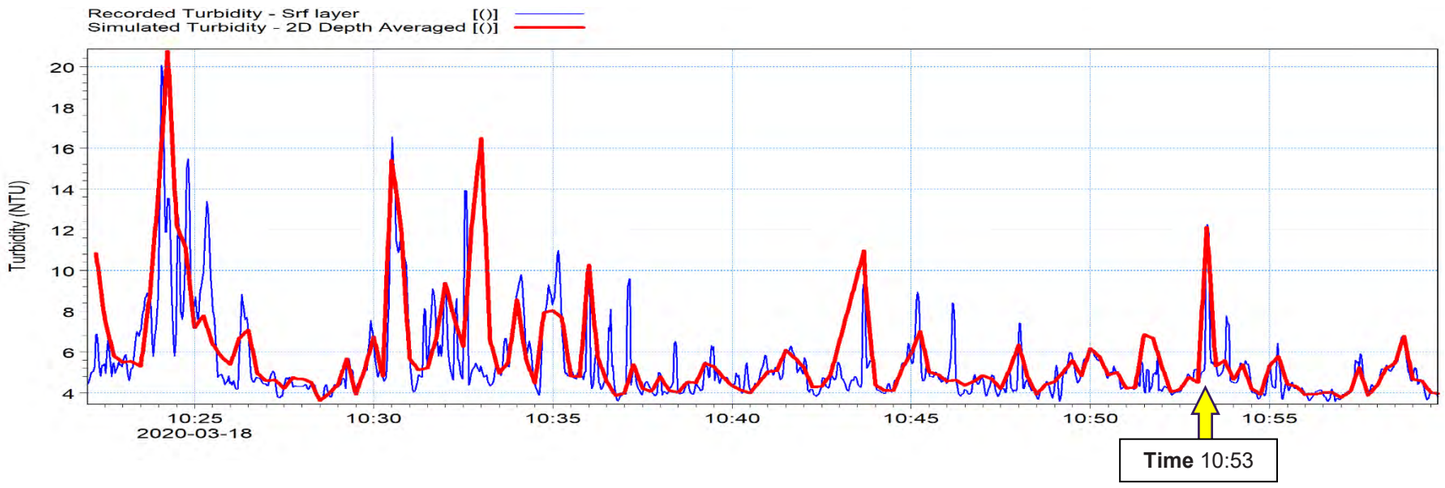


Figure 6.6 Event 280. 2D Sediment plume envelope *c.* 28min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)





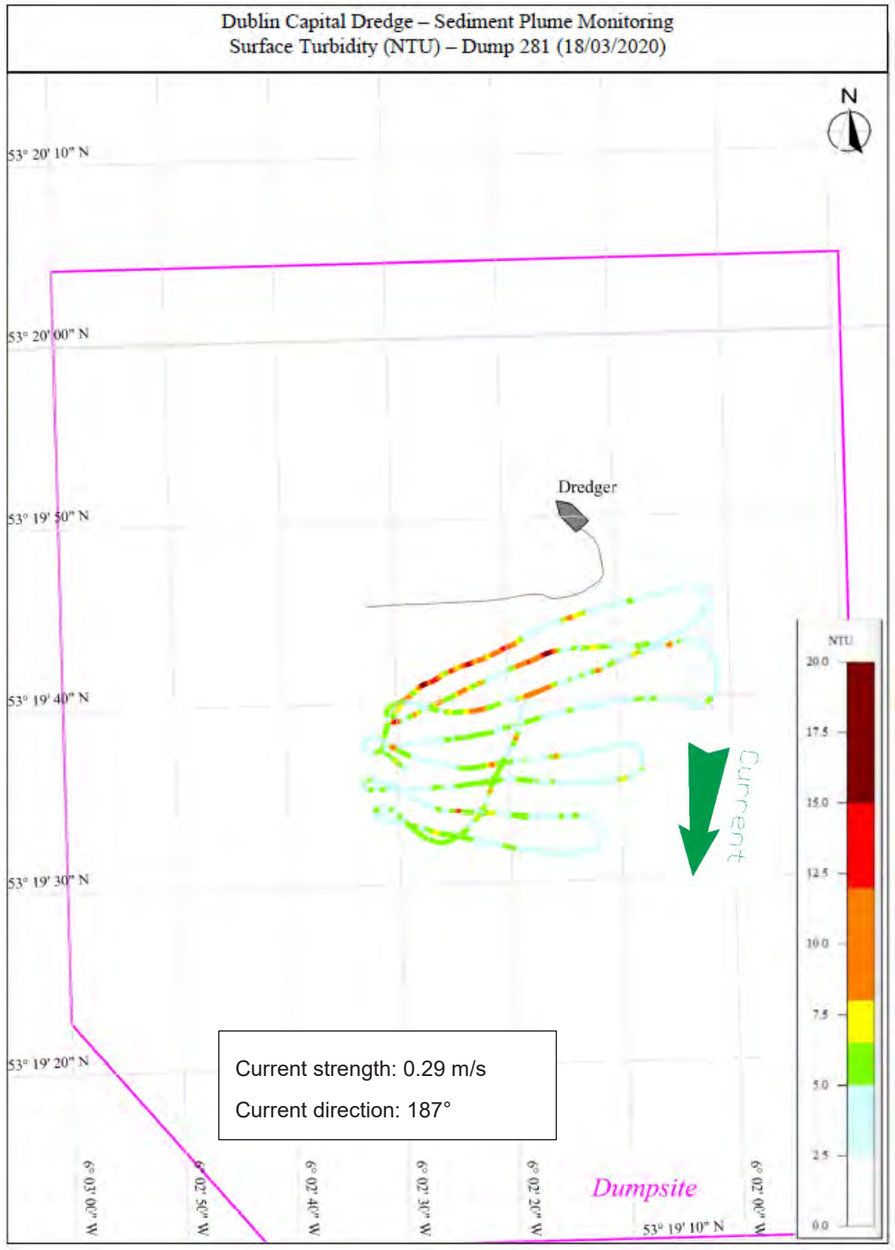
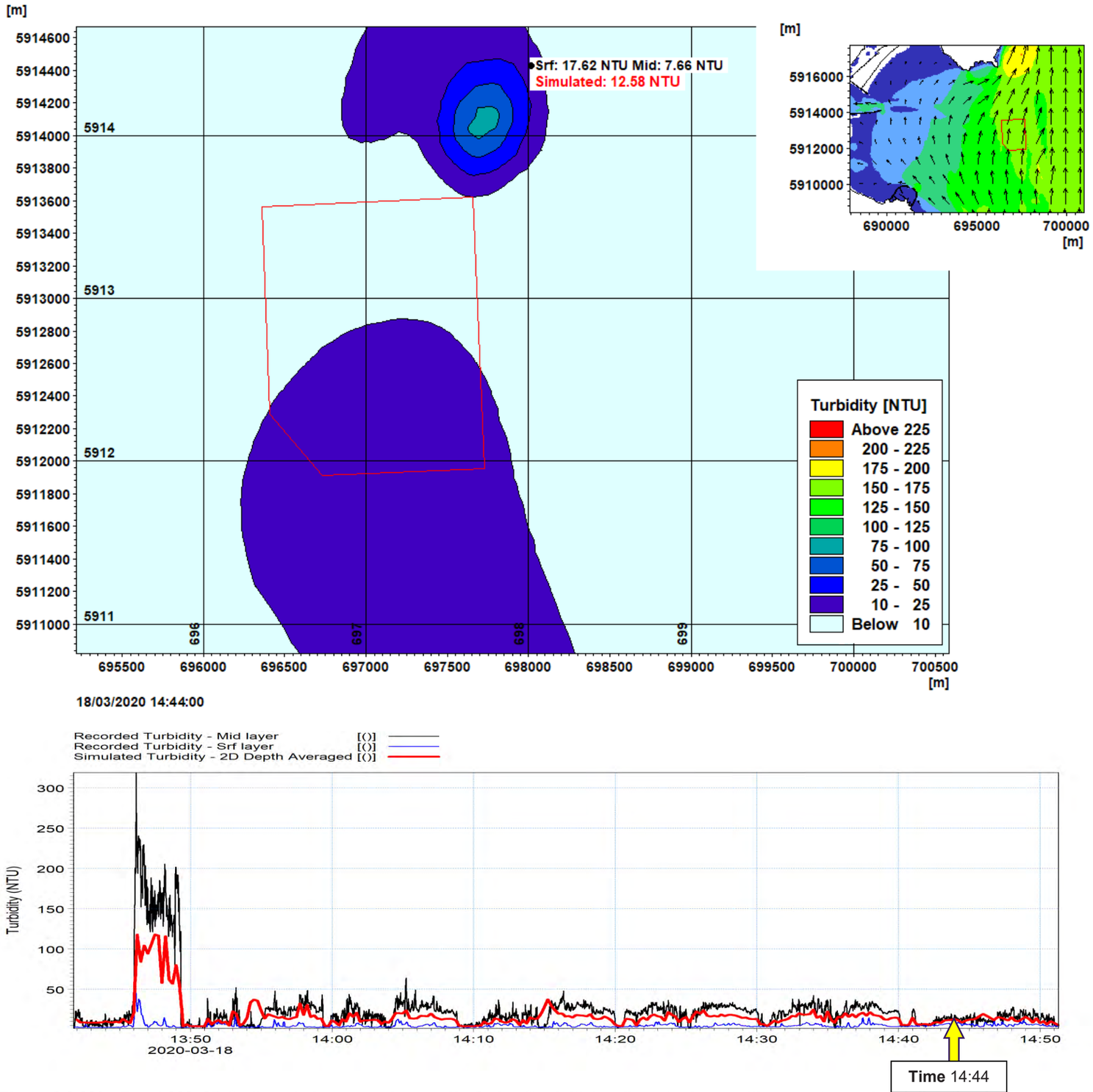


Figure 6.7 Event 281. 2D Sediment plume envelope *c.* 31min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)



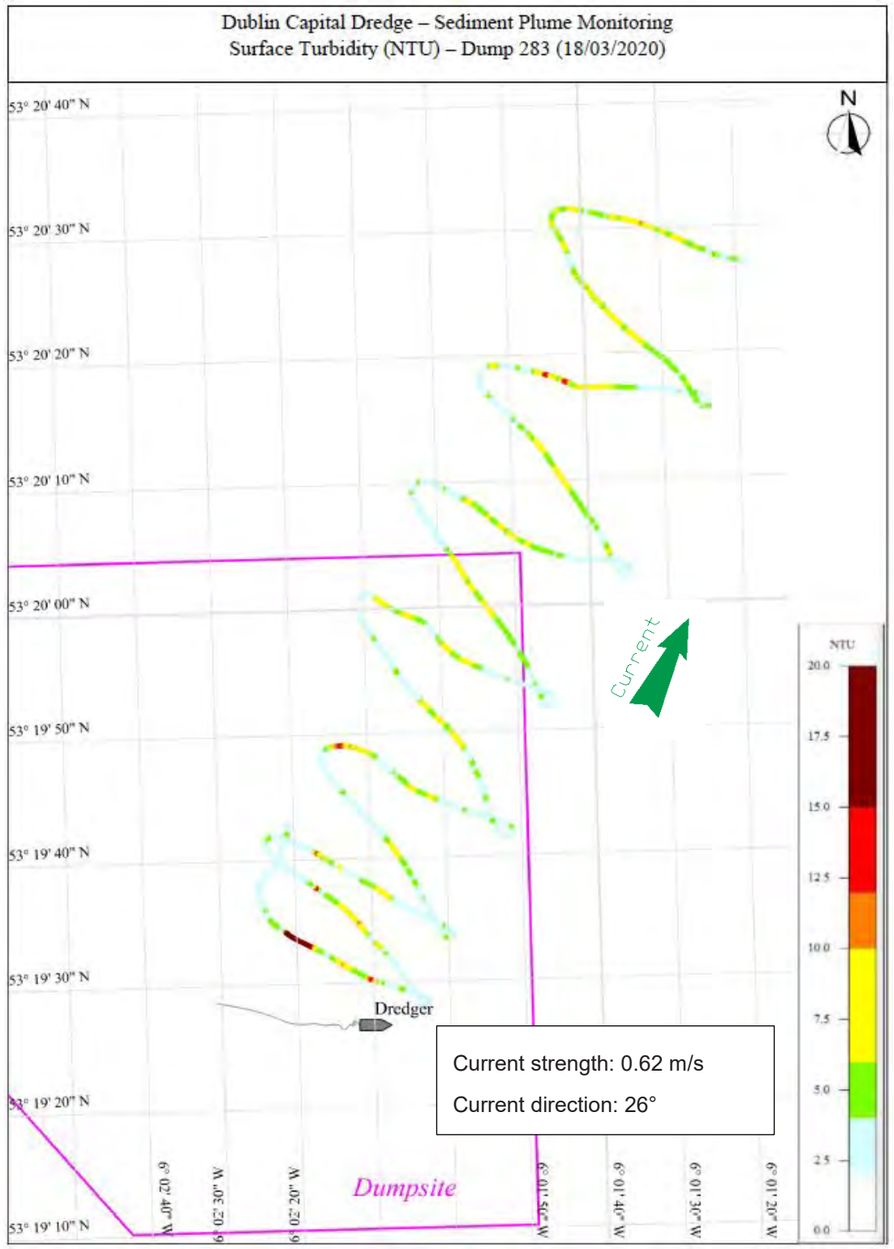


Figure 6.8 283: Event 283. 2D Sediment plume envelope *c.* 1hr 2min after initial sediment release with current speed and direction insert (top left). Extent of survey data (top right) and comparison with simulated data (bottom left)

7 CONCLUSIONS

Dublin Port Company (DPC) was granted a Dumping at Sea Permit (S0024-01) by the Environmental Protection Agency (EPA) on 13th September 2016 for the loading and dumping at sea of dredged material arising from capital dredging as part of the Alexandra Basin Redevelopment (ABR) Project. The permit sets out in detail the conditions under which DPC will carry out loading and dumping at sea.

In order to satisfy Condition 4.11 of this permit RPS undertook an extensive modelling programme to validate the numerical modelling parameters used in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application.

- This was achieved using project specific monitoring data collected by Hydromaster (Hydromaster, 2020).
- Produce sediment plume plots for dumping events of the March 2020 campaign during which dredging took place within the inner Liffey channel over a range of spring and neap tidal conditions.

In summary, this assessment found that:

- The sediment was specified correctly in Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the application and that the numerical modelling parameters used for this technical assessment were valid and fit for purpose.
- Simulated turbidity levels were generally found to be well within the surface and mid-point envelope of recorded turbidity levels for all dump events.
- Turbidity levels beyond the immediate vicinity of the dump site did not generally exceed the background turbidity levels recorded when there was no dumping. This is confirmed by the Hydromaster survey tracks presented in Appendix A.
- Sediment plumes did not disperse into the inner Dublin Bay area.
- The tidal conditions at the dump site are fully dispersive for material dominated by silt.

Based on the findings of this technical assessment it can be concluded that the dispersion, fate of sediment plumes arising from the dredging and disposal operations associated with the ABR Project will not significantly impact water quality in Dublin Bay or beyond.

8 REFERENCES

Hydromaster. (2020). Dublin Bay Sediment Plume Monitoring Report.

RPS. (2003). Irish Coastal Protection Strategy Study.

RPS. (2014). Alexandra Basin Redevelopment Project - Environmental Impact Statement (Vol. 1).

RPS. (2014). Appendix C: Coastal Process Modelling to the Natura Impact Statement submitted as part of the Dumping at Sea Permit application.

RPS. (2018). Alexandra Basin Redevelopment Project - Construction Environmental Management Plan.

Appendix A Hydromaster Survey Monitoring Tracks and Comparison with Model Simulations

A.1 Vessel track and Turbidity data (surface and mid-water)

The following Figures have been taken from (Hydromaster, 2020) and display the track of the survey vessel with turbidity data overlaid, the current direction and speed is also displayed:

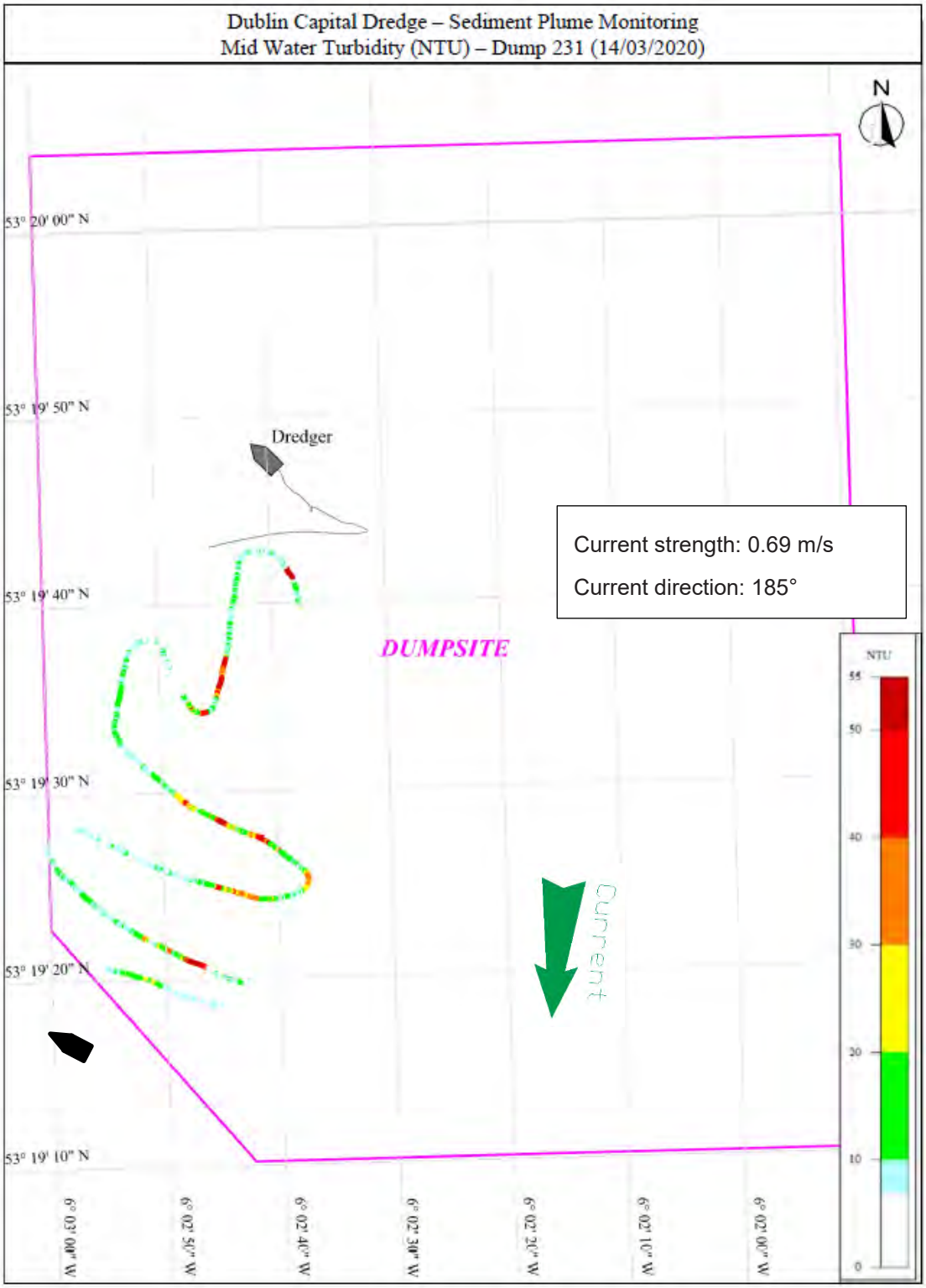


Figure 8.1: Dump 231 Survey track with mid water turbidity [NTU]

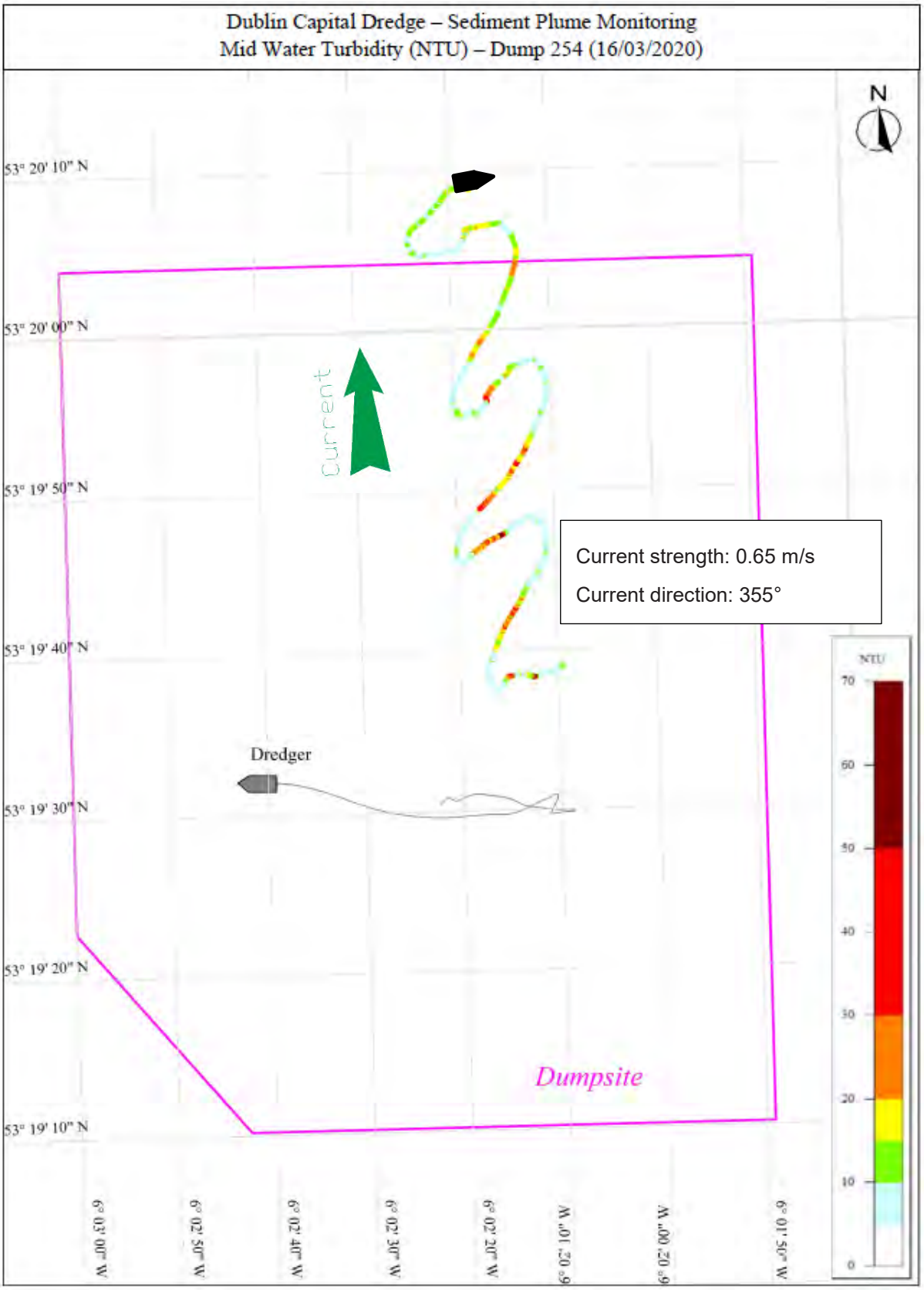


Figure 8.2: Dump 254 Survey track with mid water turbidity [NTU]

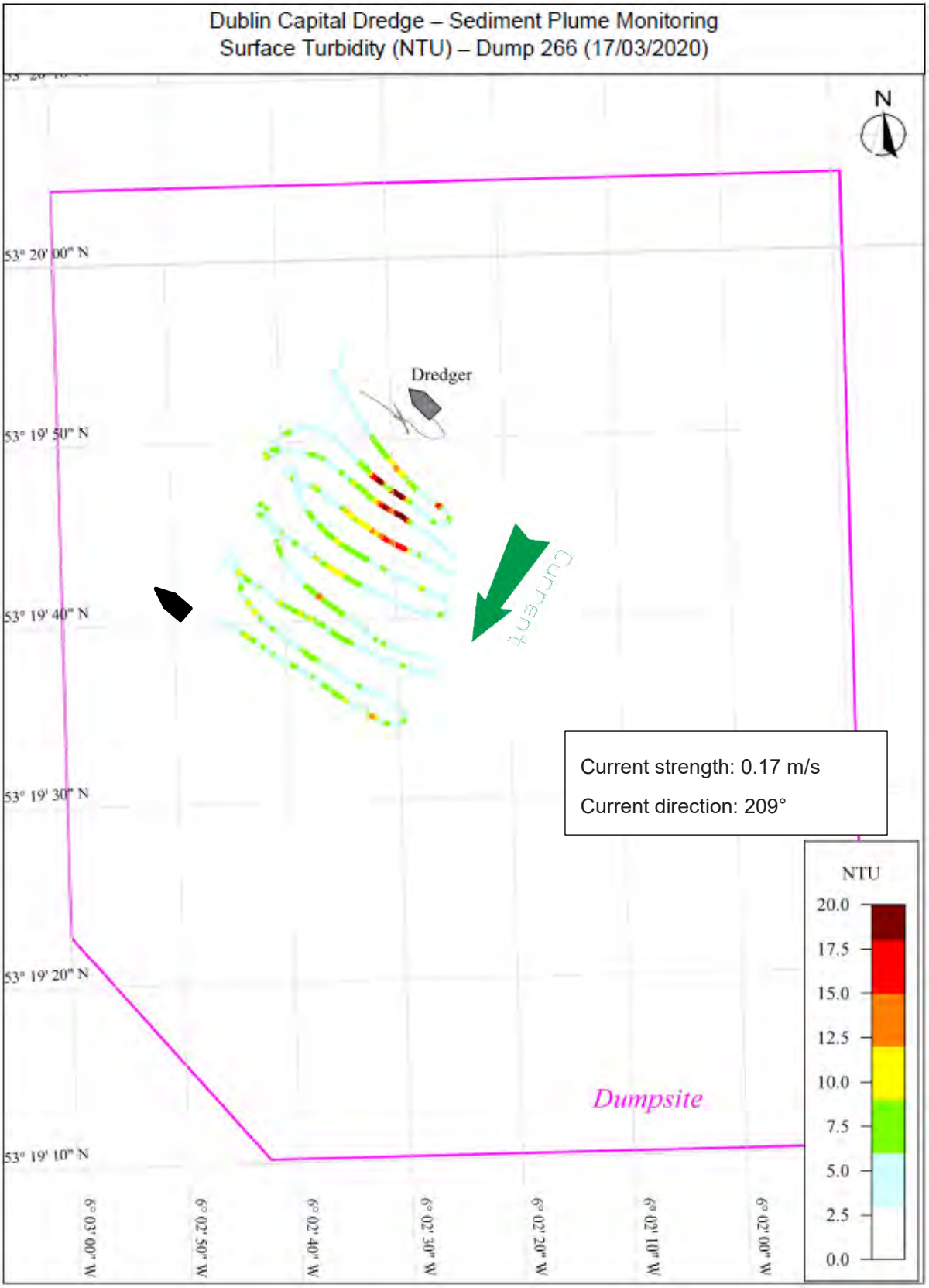


Figure 8.3: Dump 266 Survey track with surface turbidity [NTU]

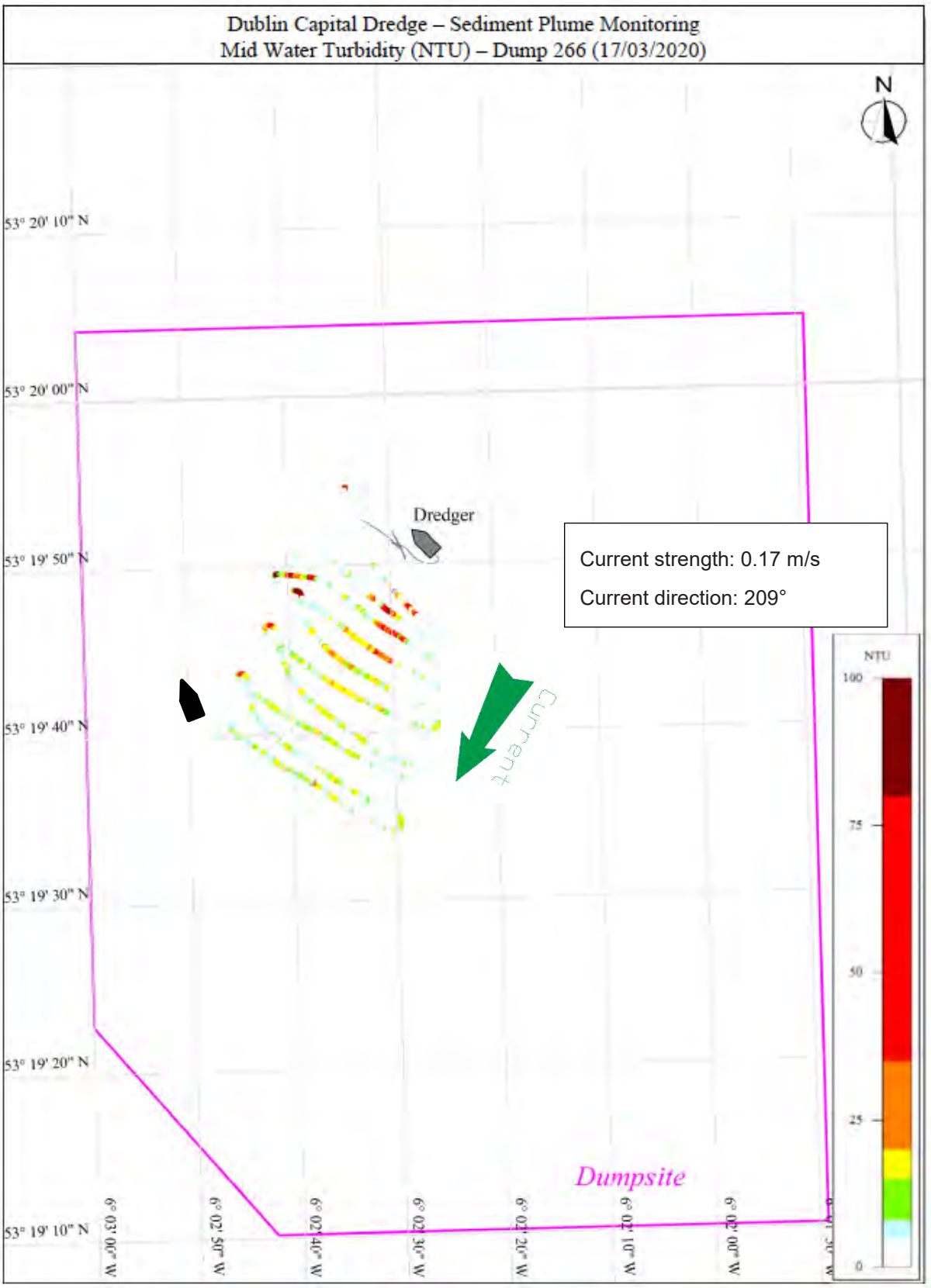


Figure 8.4: Dump 266 Survey track with mid water turbidity [NTU]

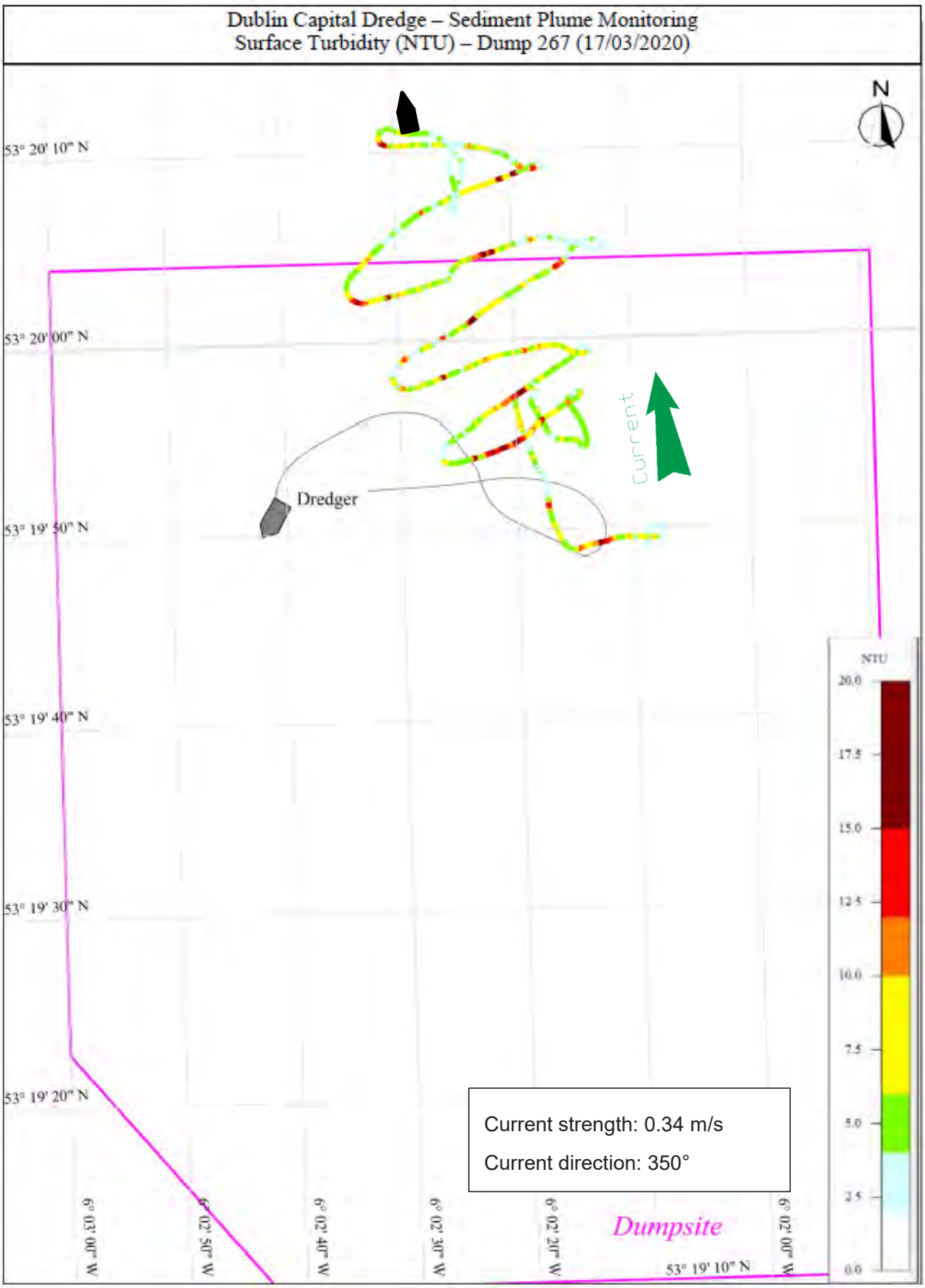


Figure 8.5: Dump 267 Survey track with surface turbidity [NTU]

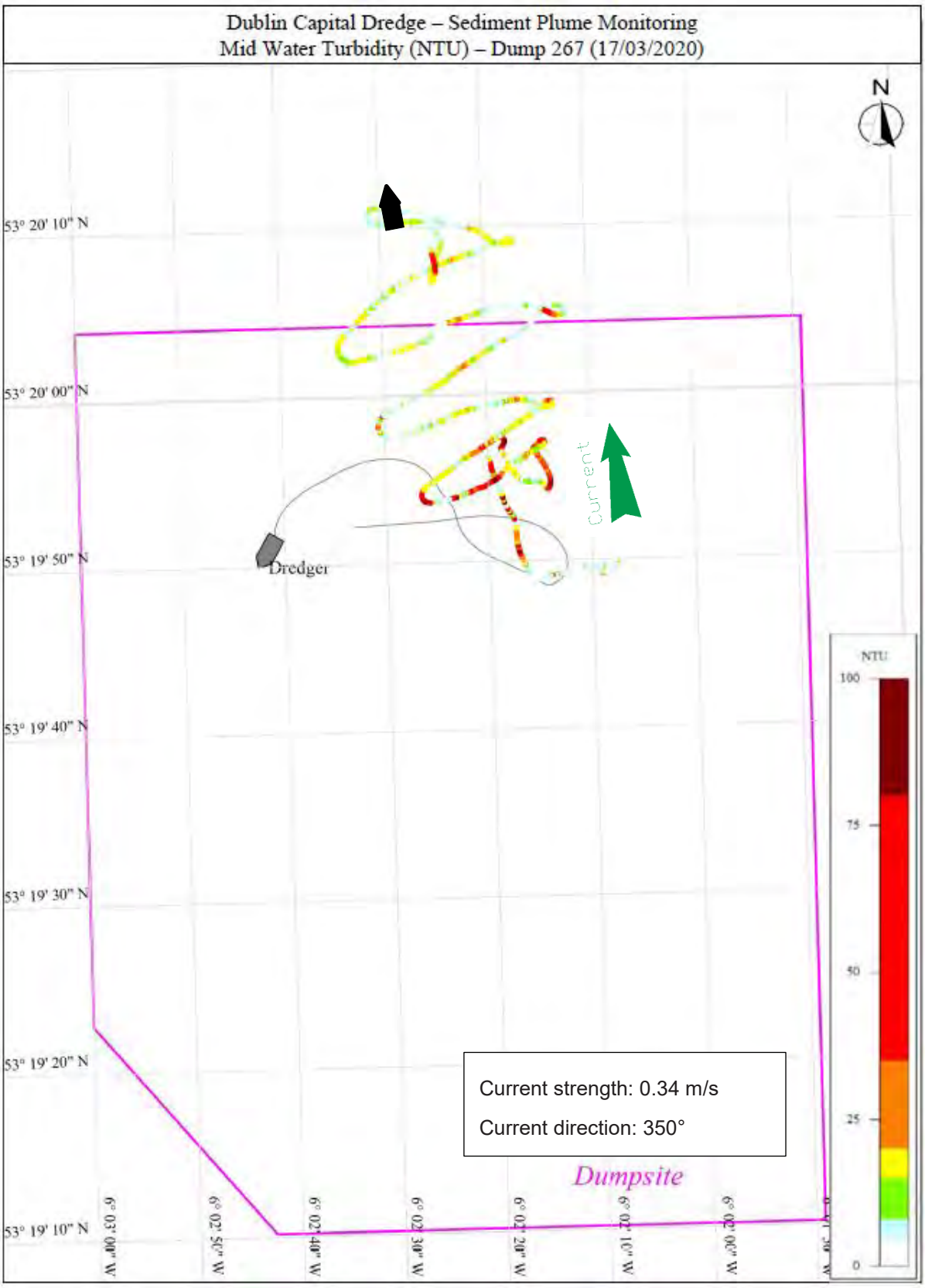


Figure 8.6: Dump 267 Survey track with mid water turbidity [NTU]

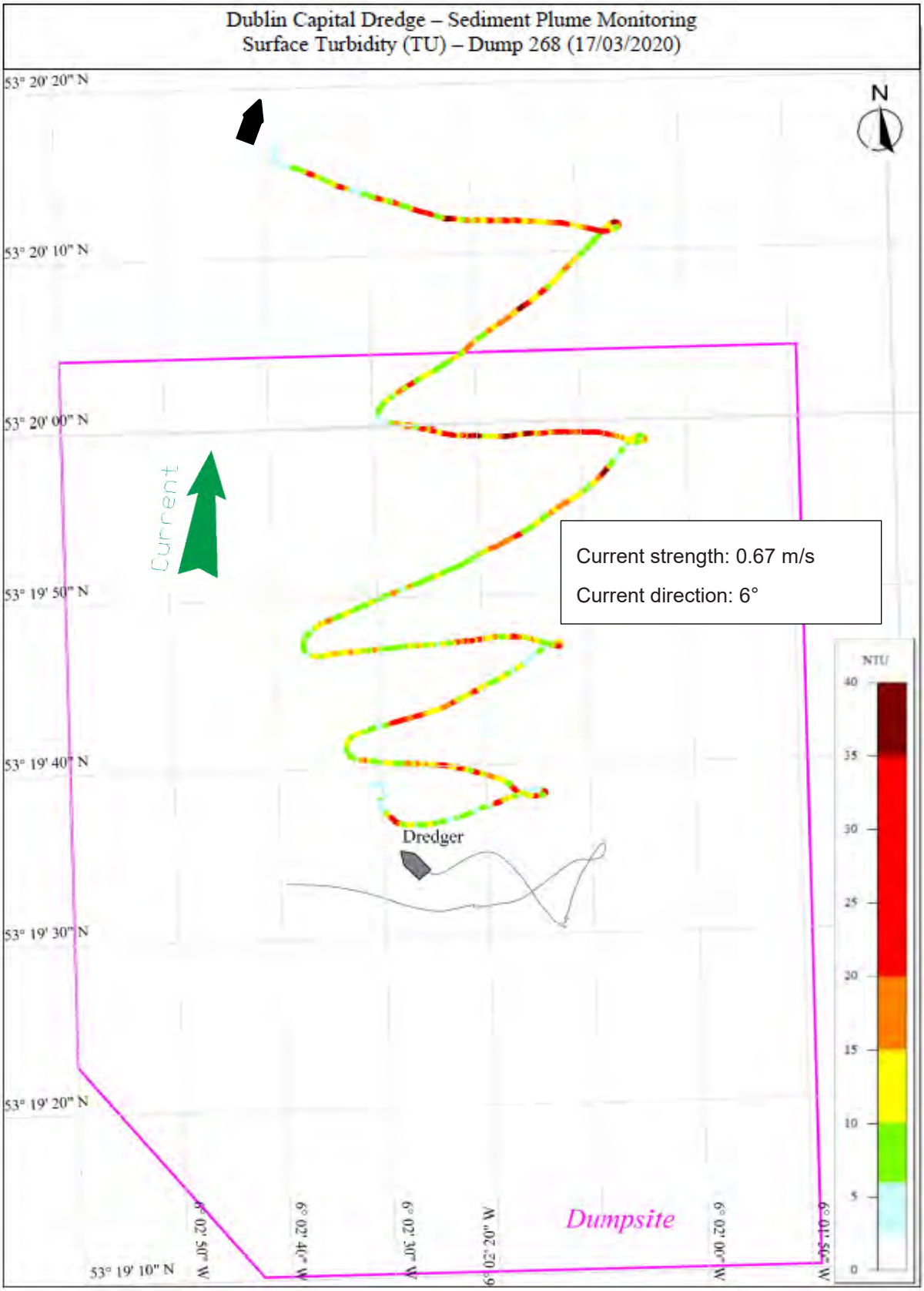


Figure 8.7: Dump 268 Survey track with surface turbidity [NTU]

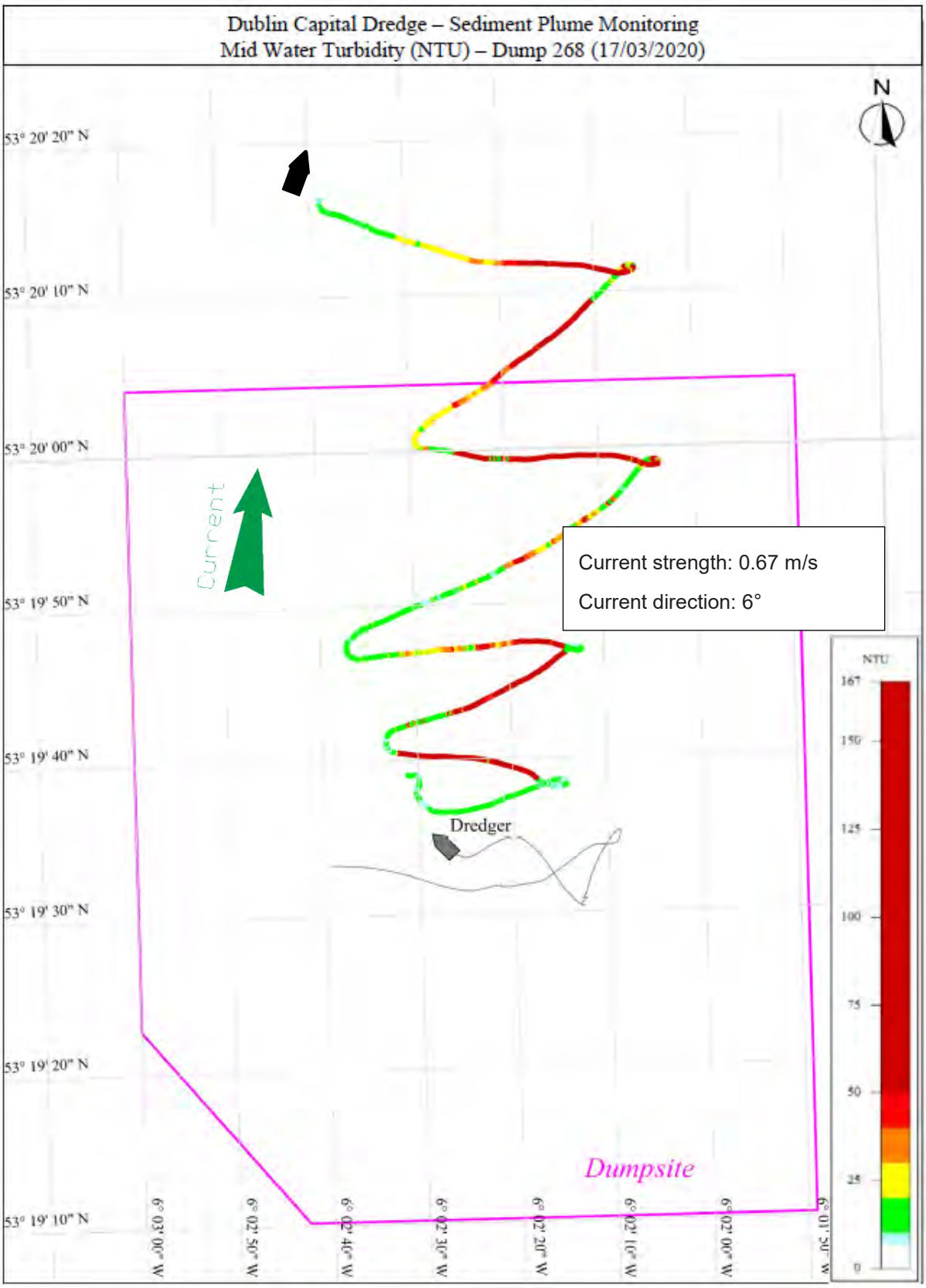


Figure 8.8: Dump 268 Survey track with mid water turbidity [NTU]

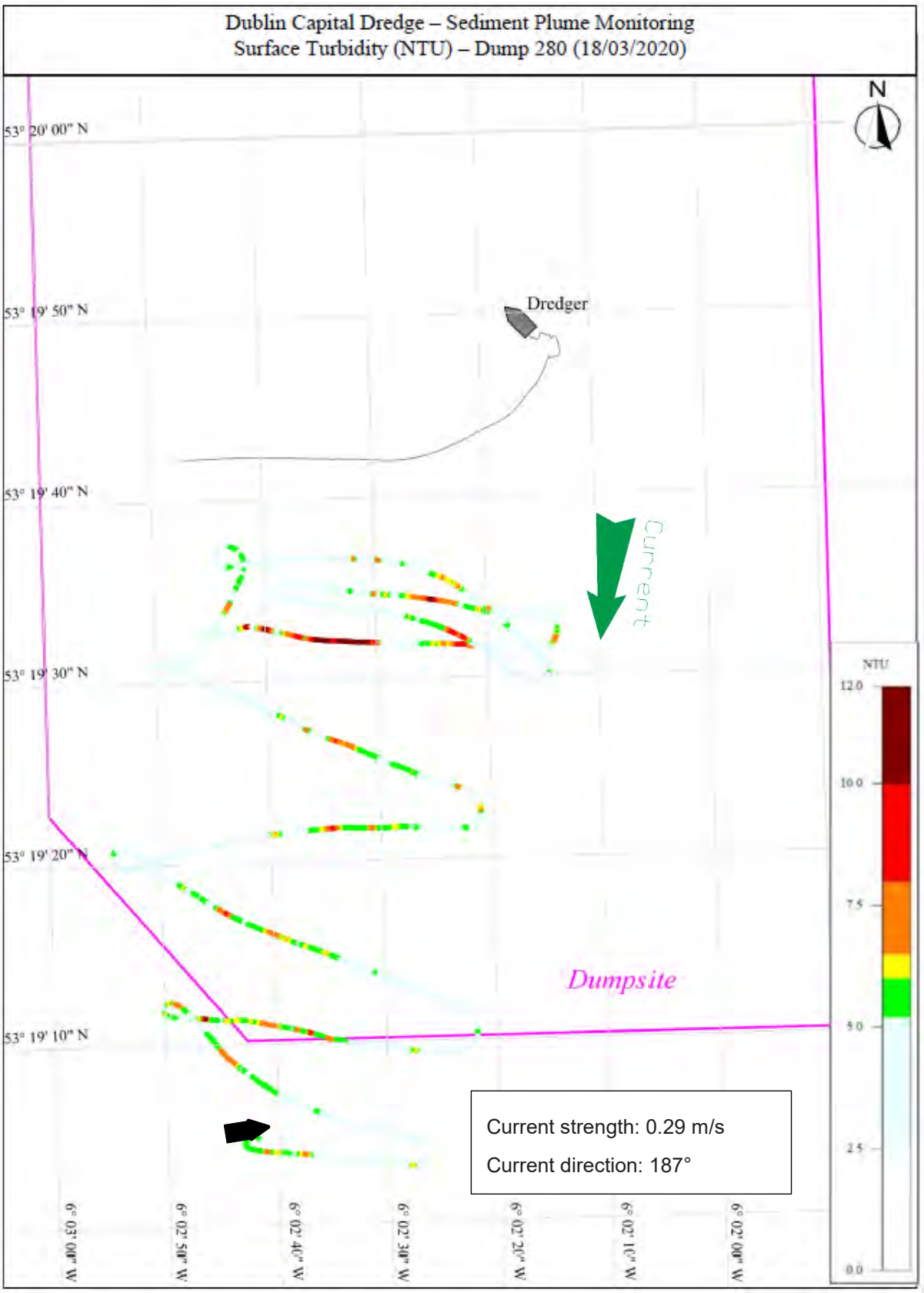


Figure 8.9: Dump 280 Survey track with surface turbidity [NTU]

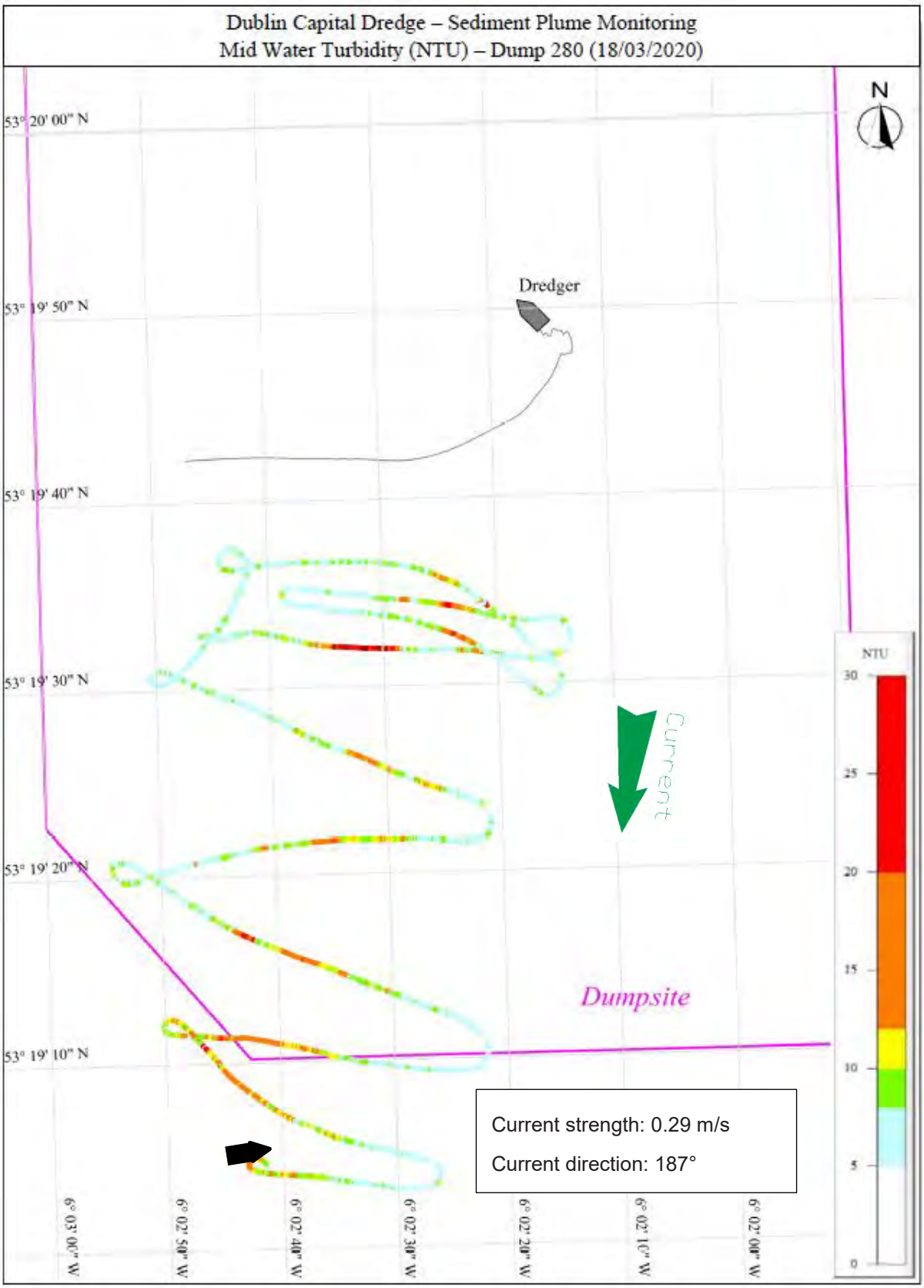
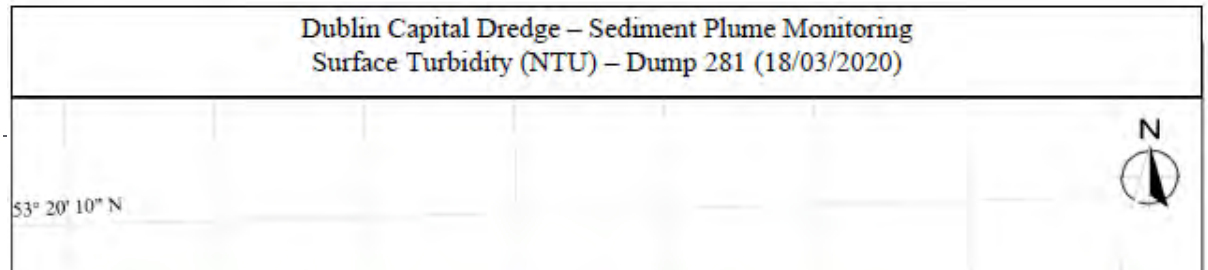


Figure 8.10: Dump 280 Survey track with mid water turbidity [NTU]



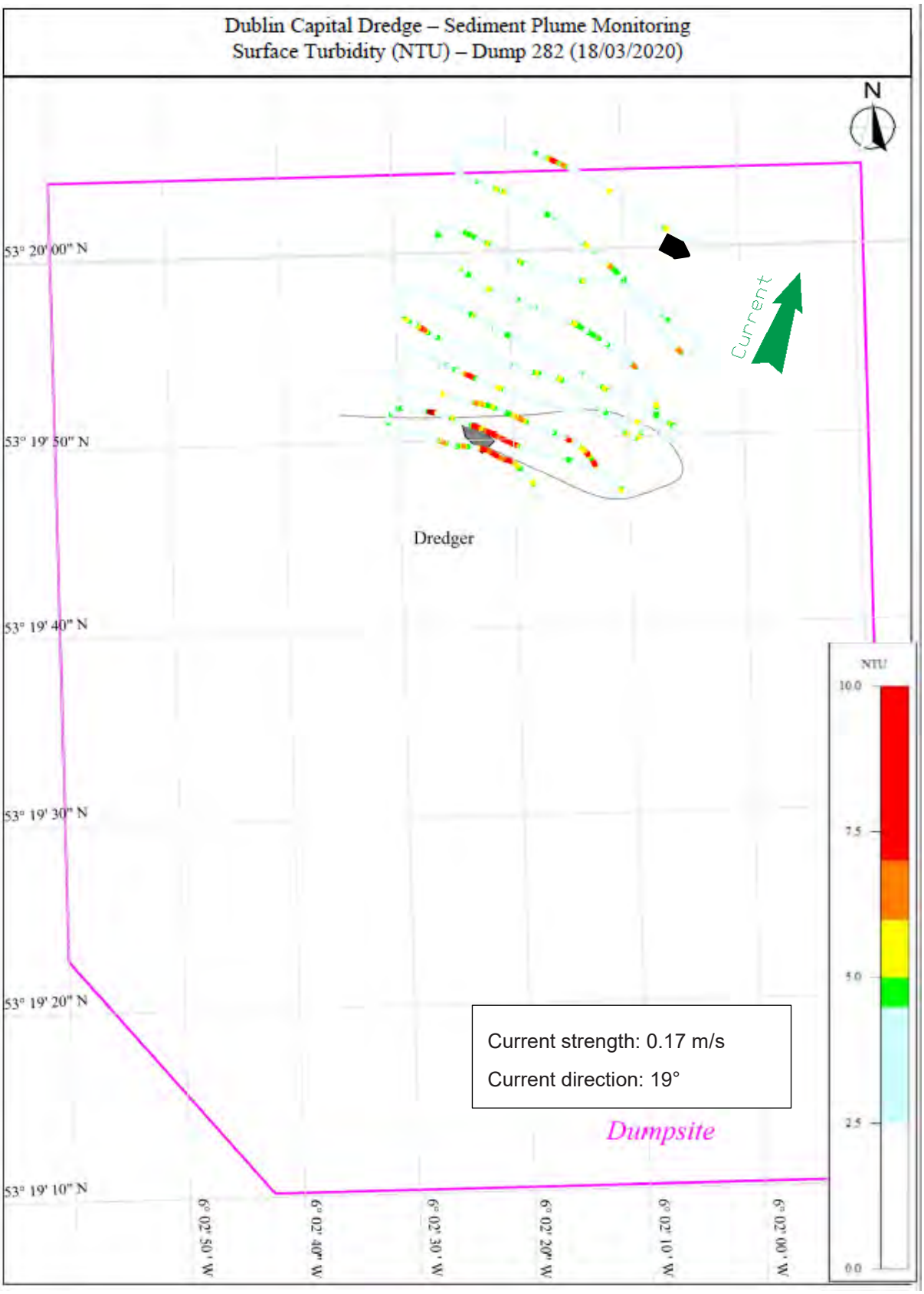


Figure 8.12: Dump 282 Survey track with surface turbidity [NTU]

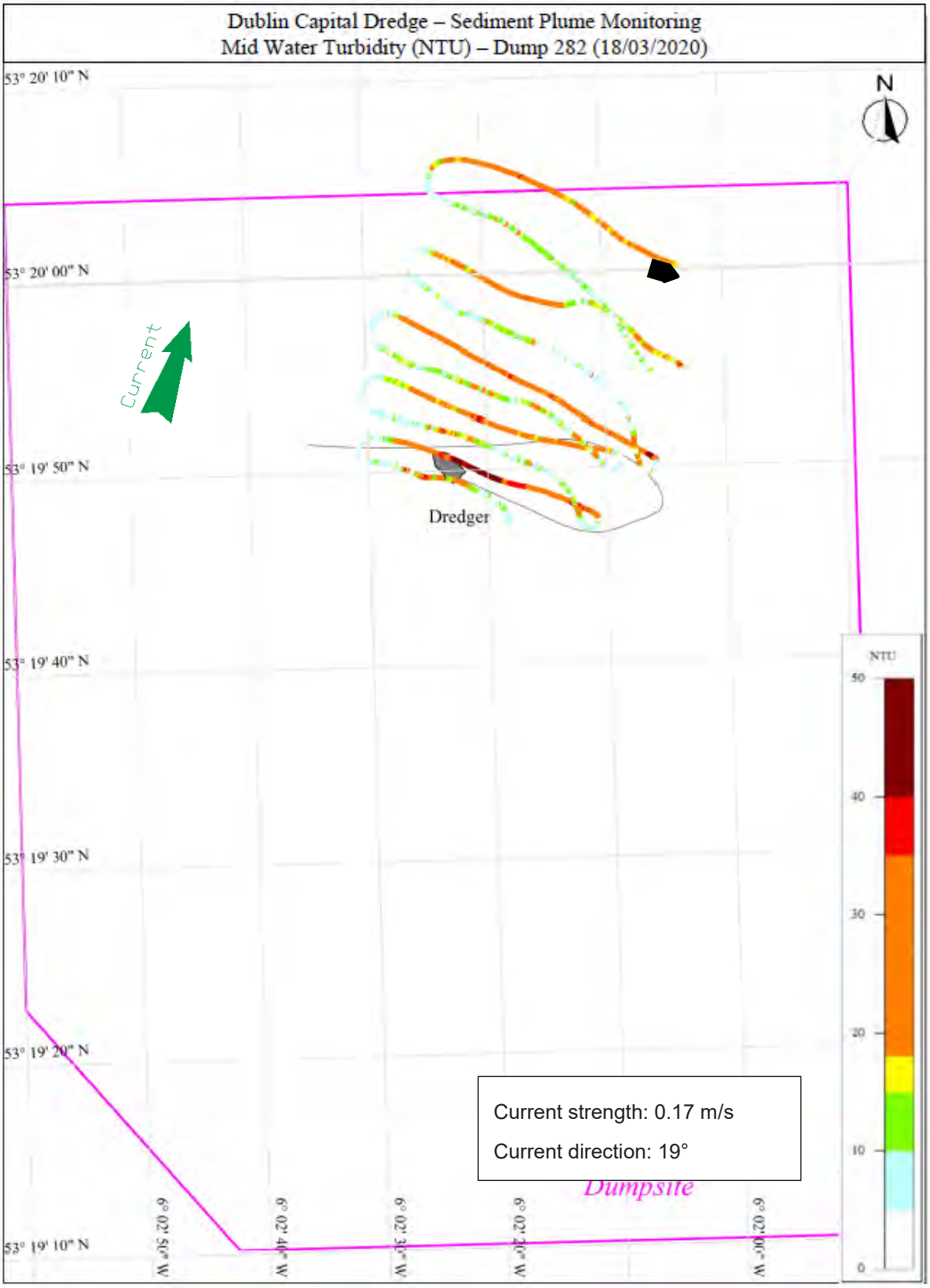


Figure 8.13: Dump 282 Survey track with mid water turbidity [NTU]

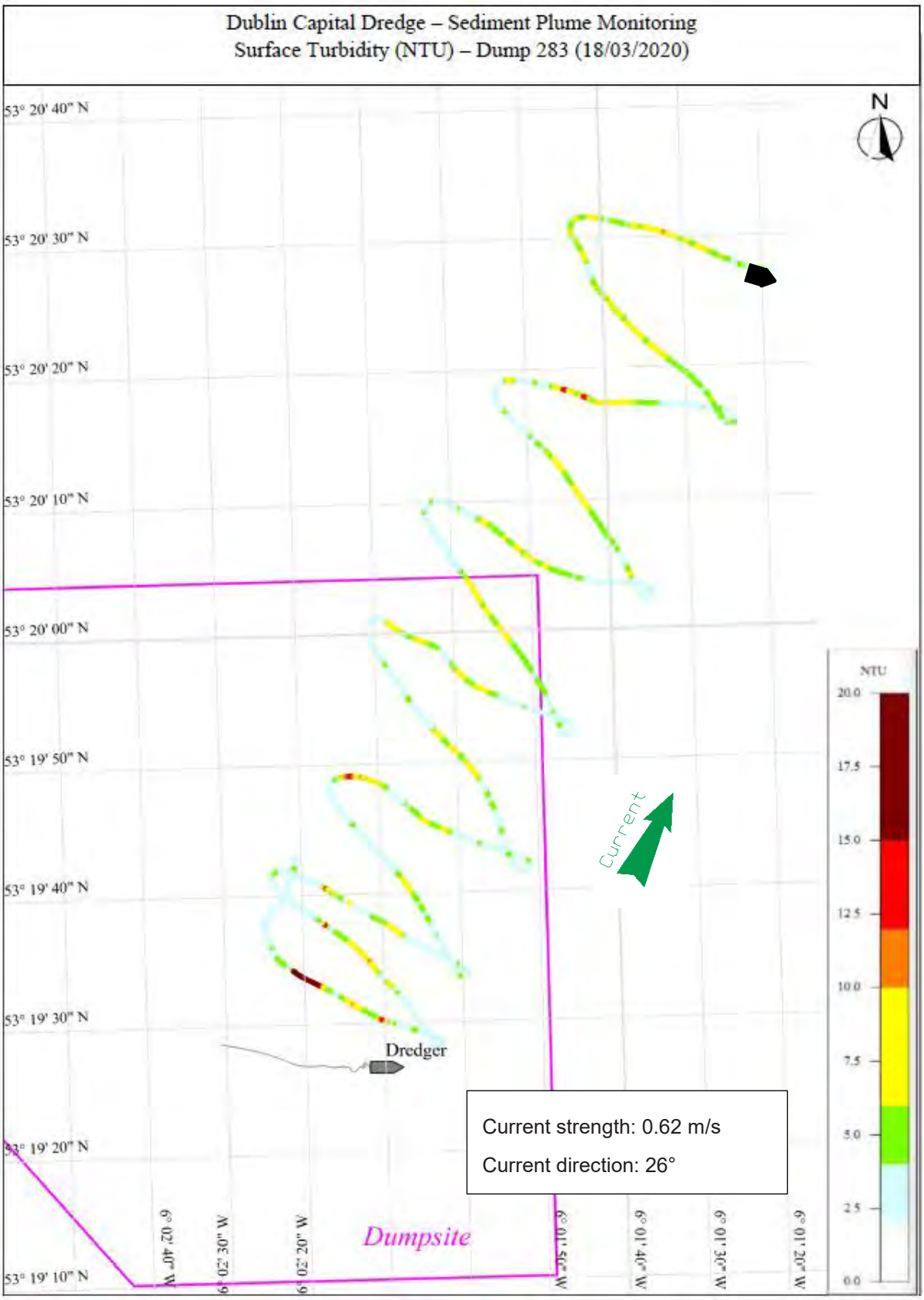


Figure 8.14: Dump 283 Survey track with surface turbidity [NTU]

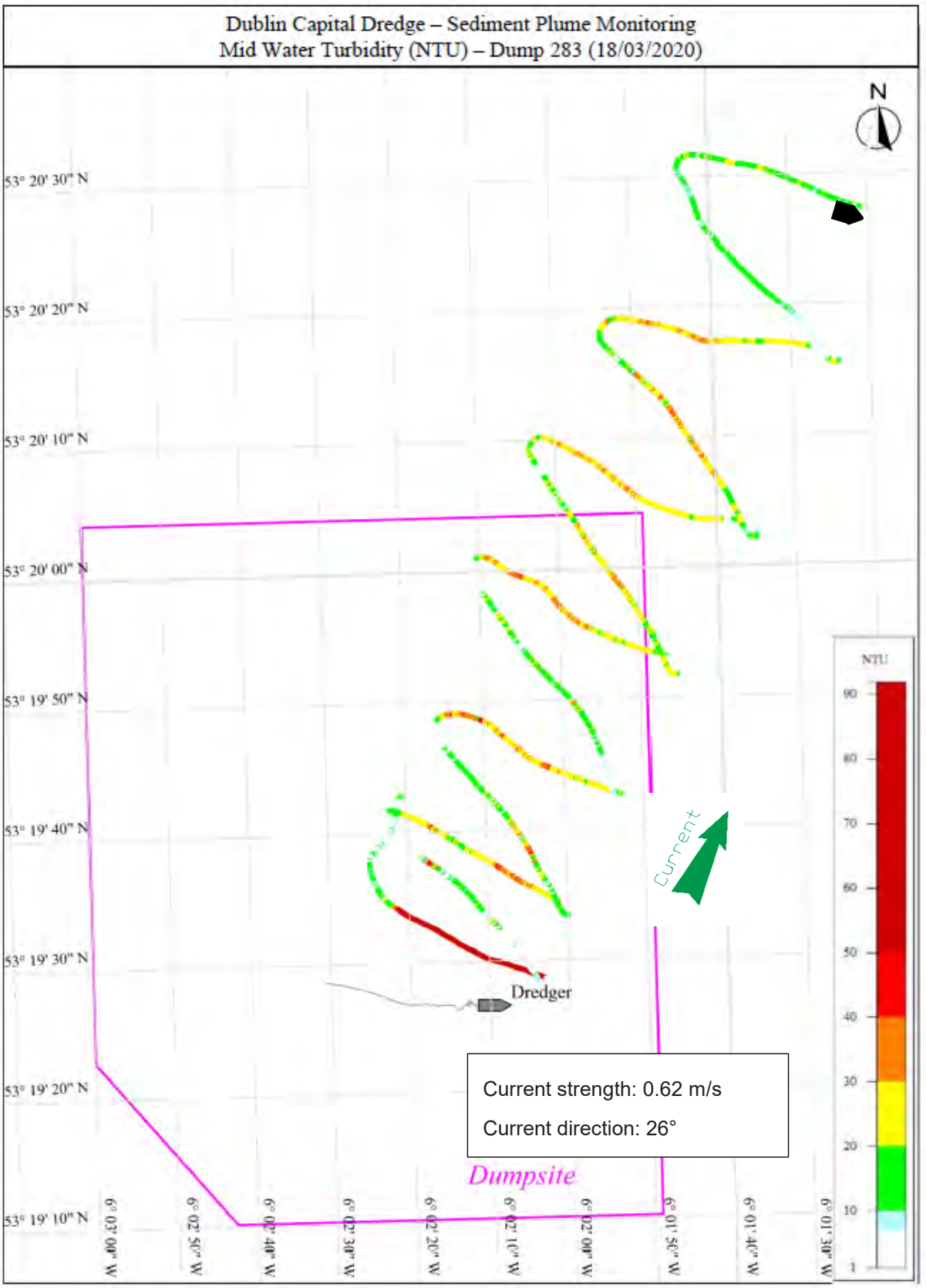


Figure 8.15: Dump 283 Survey track with mid water turbidity [NTU]

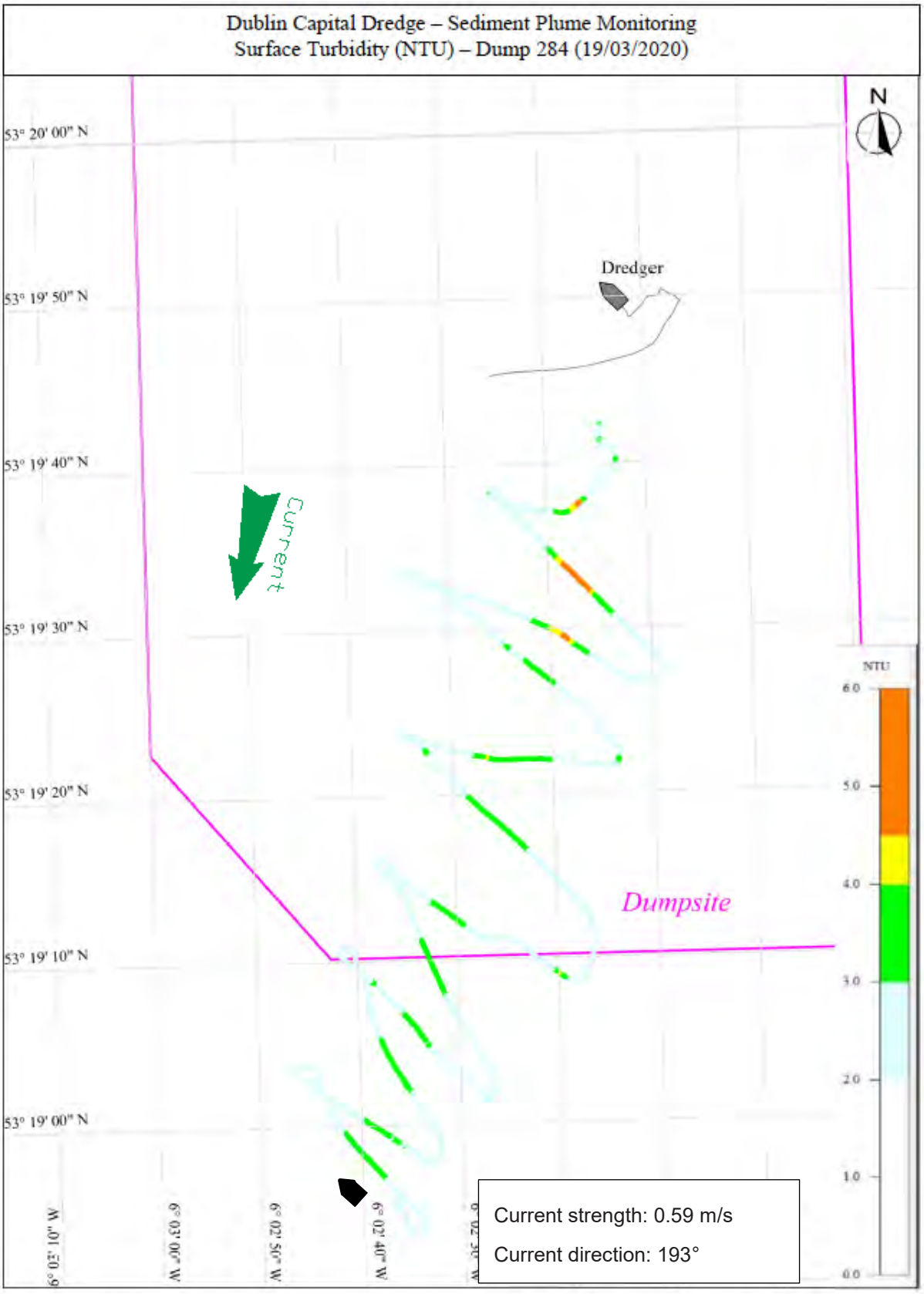


Figure 8.16: Dump 284 Survey track with surface turbidity [NTU]

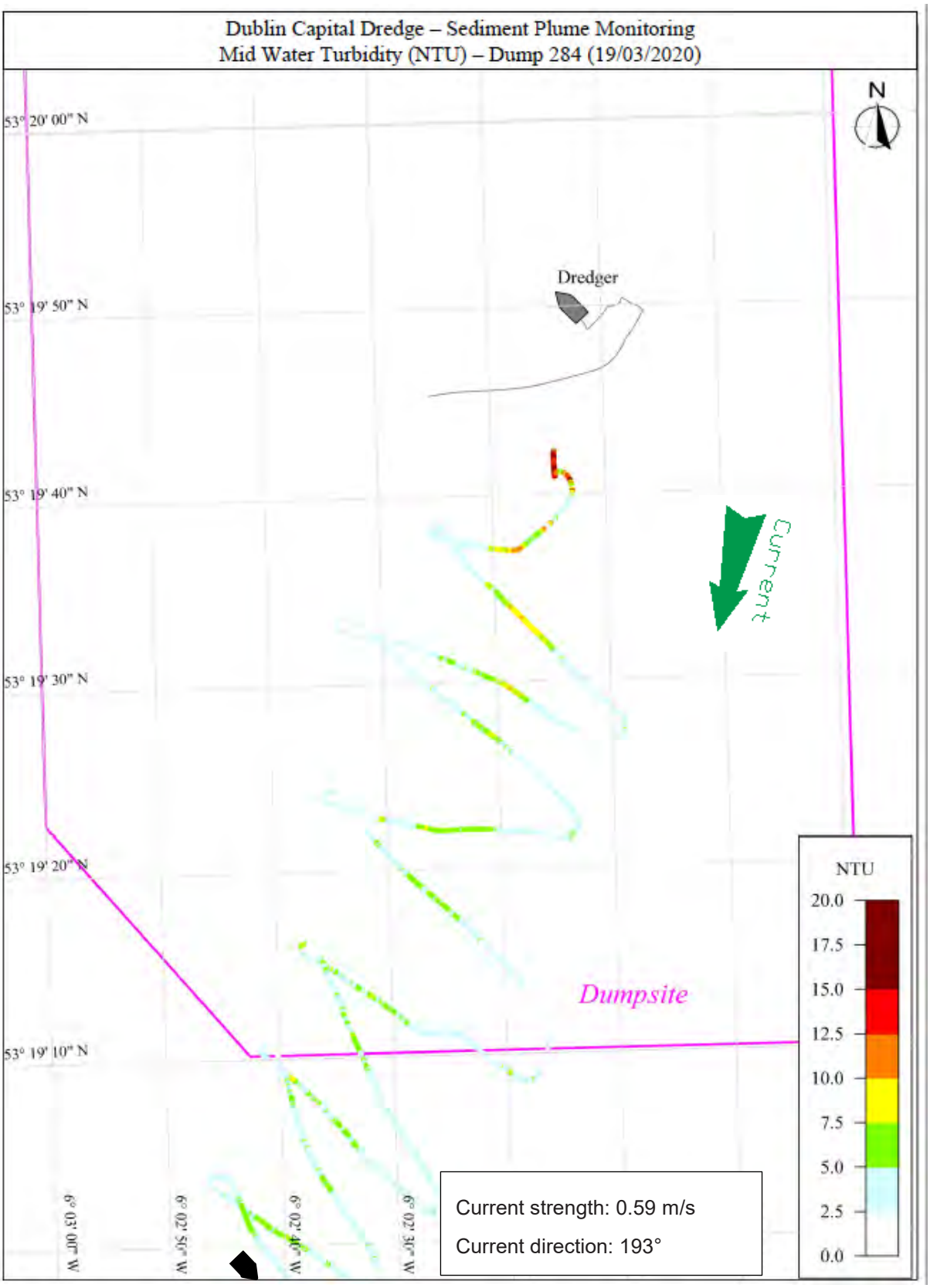


Figure 8.17: Dump 284 Survey track with mid water turbidity [NTU]

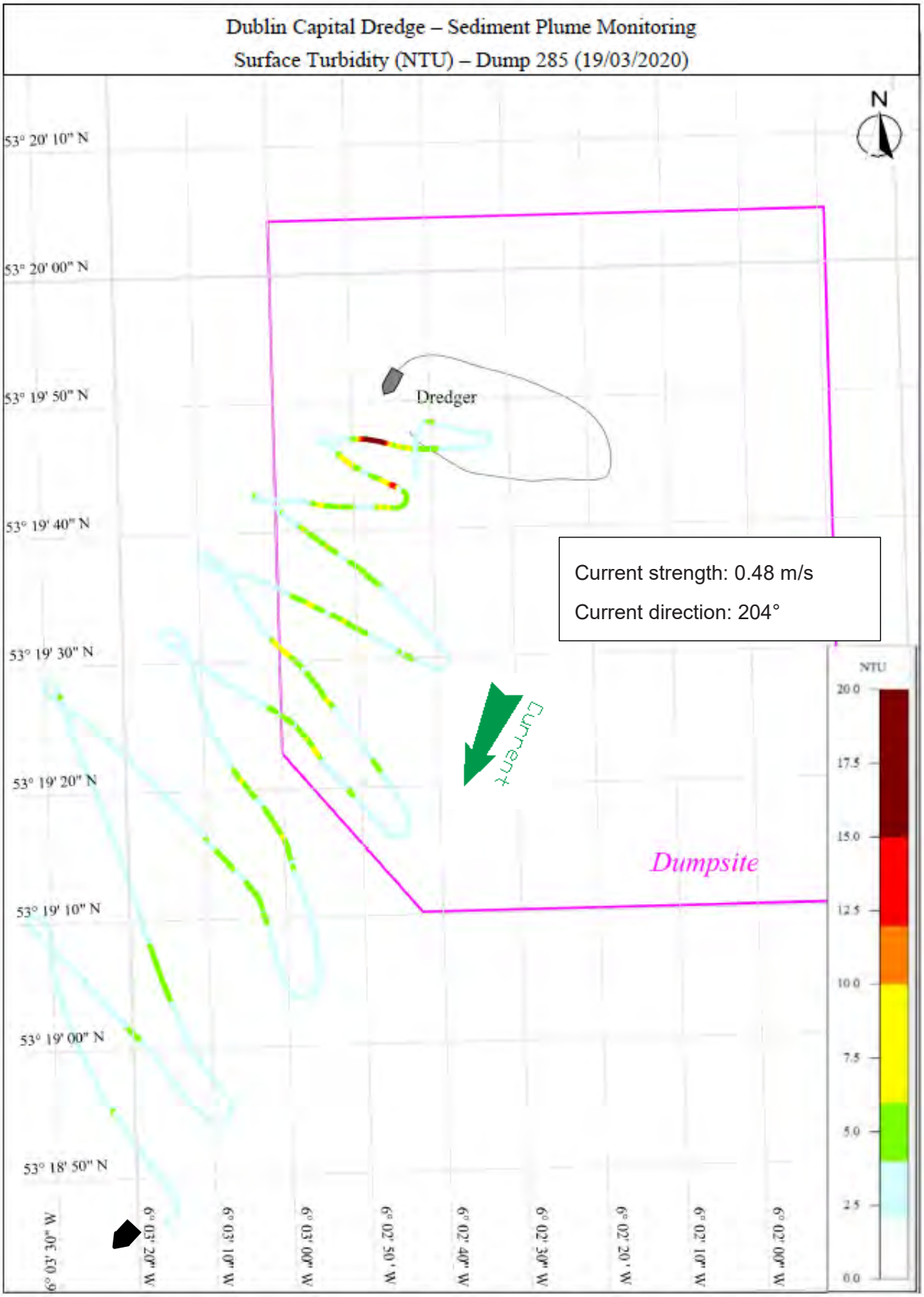


Figure 8.18: Dump 285 Survey track with surface turbidity [NTU]

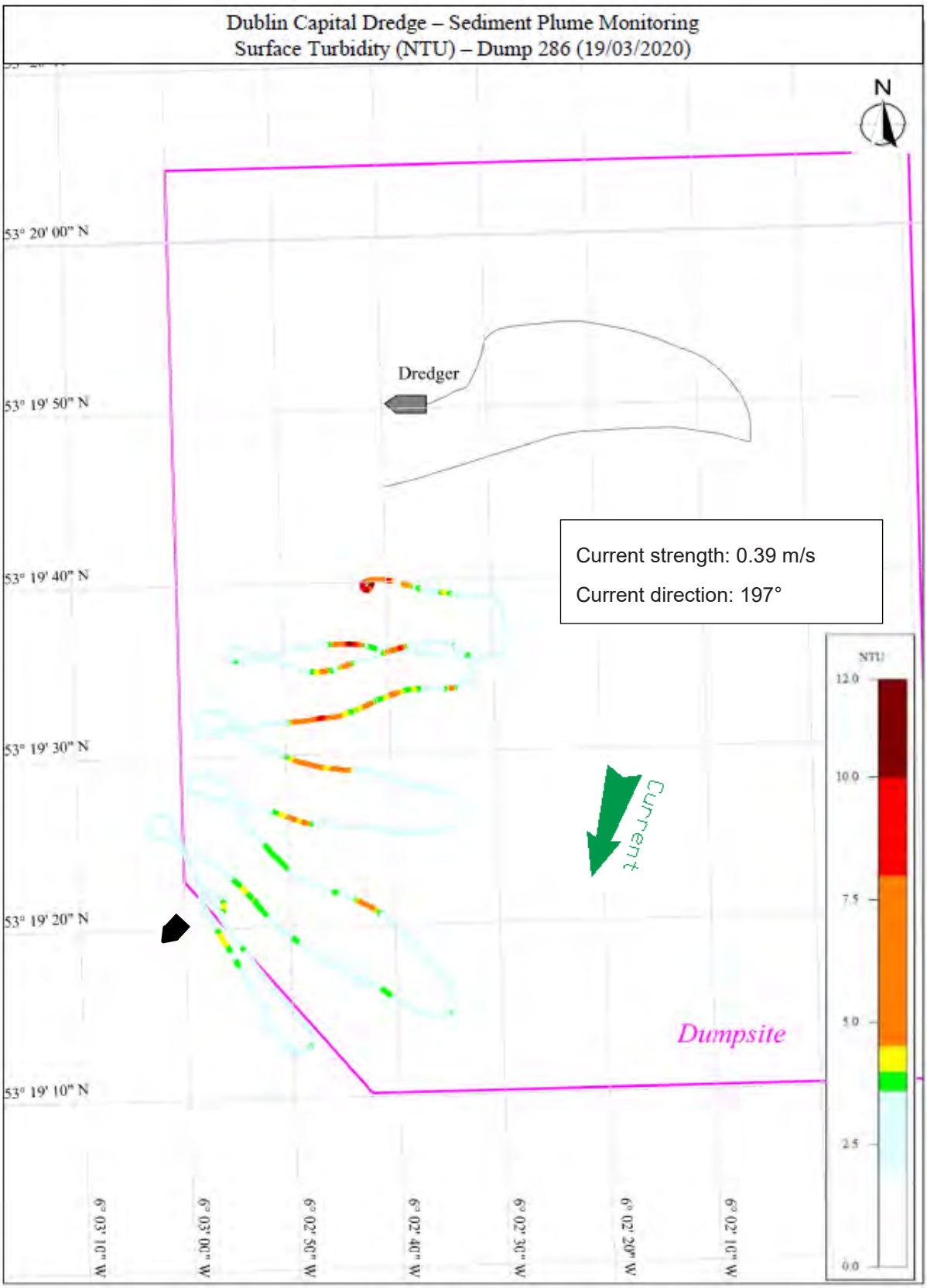


Figure 8.19: Dump 286 Survey track with surface turbidity [NTU]

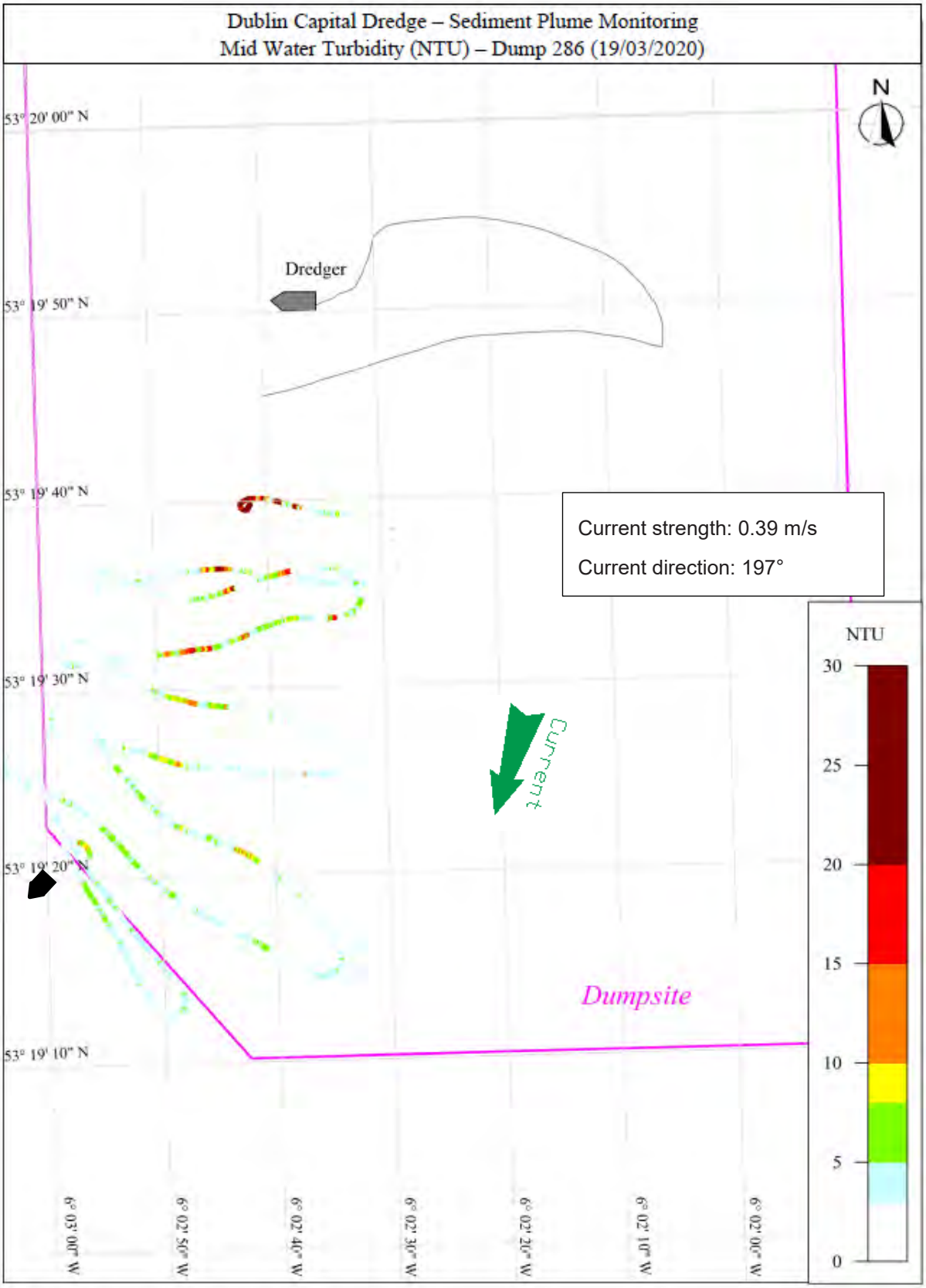


Figure 8.20: Dump 286 Survey track with mid water turbidity [NTU]

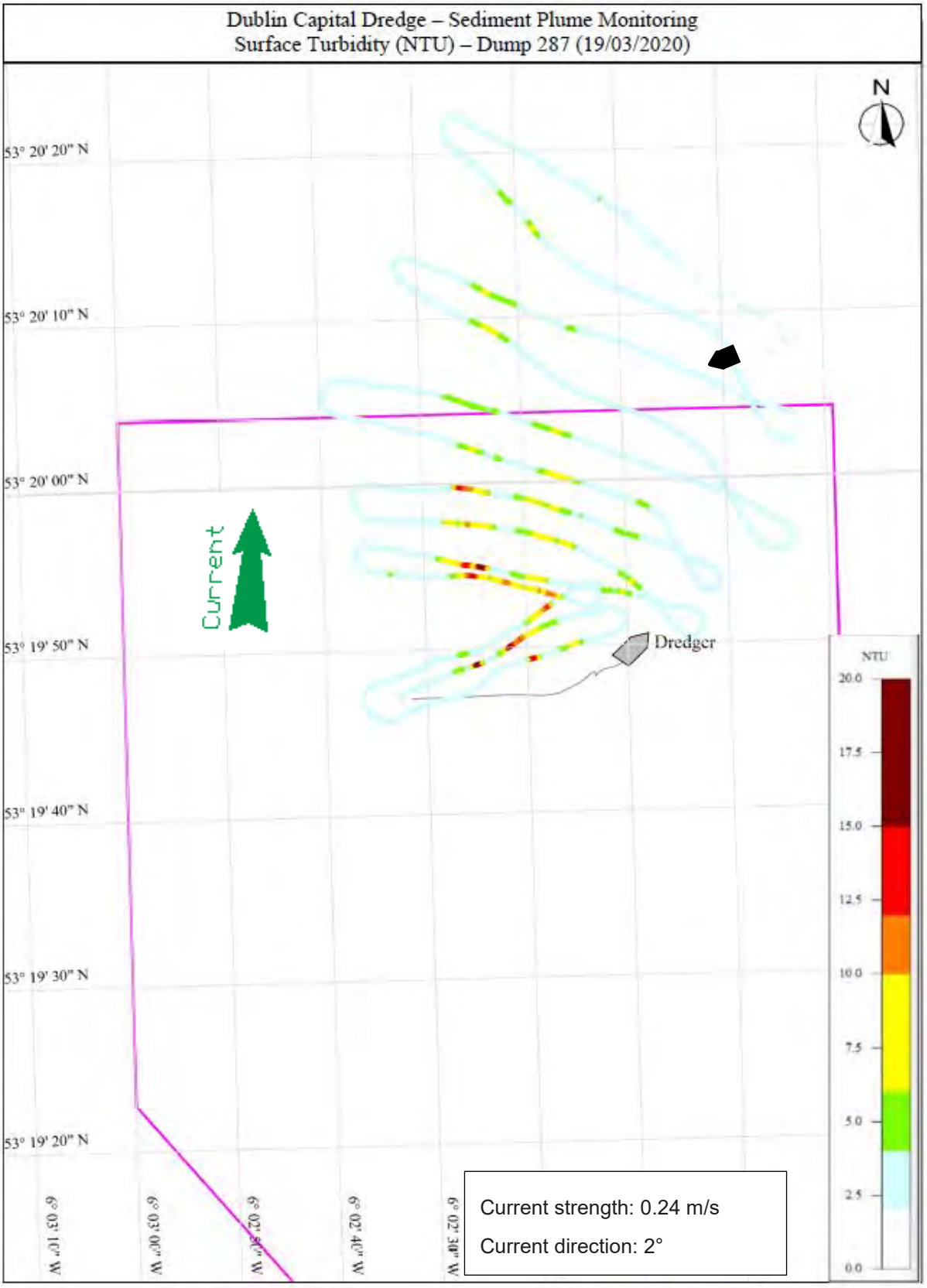


Figure 8.21: Dump 287 Survey track with surface turbidity [NTU]

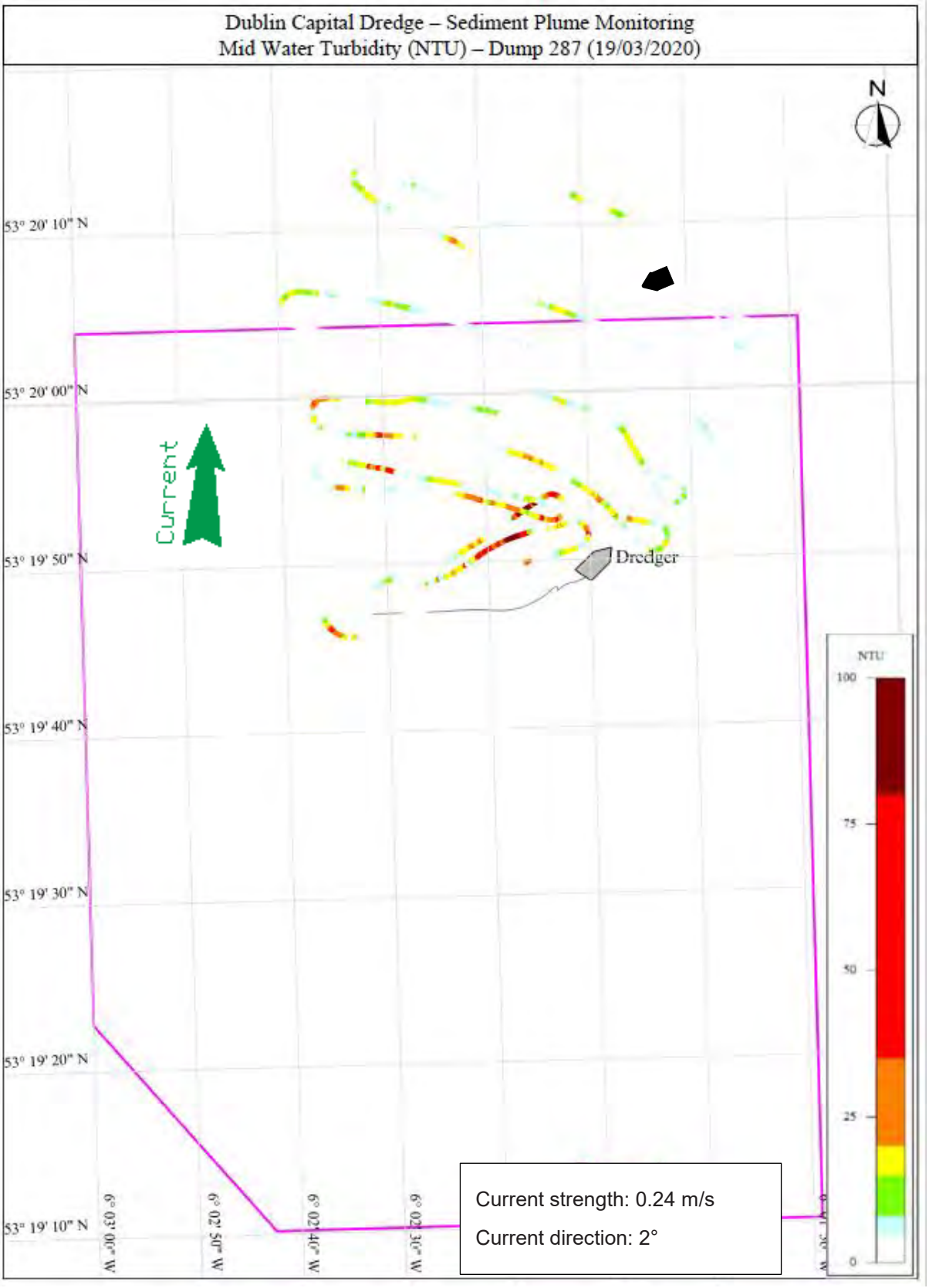


Figure 8.22: Dump 287 Survey track with mid water turbidity [NTU]

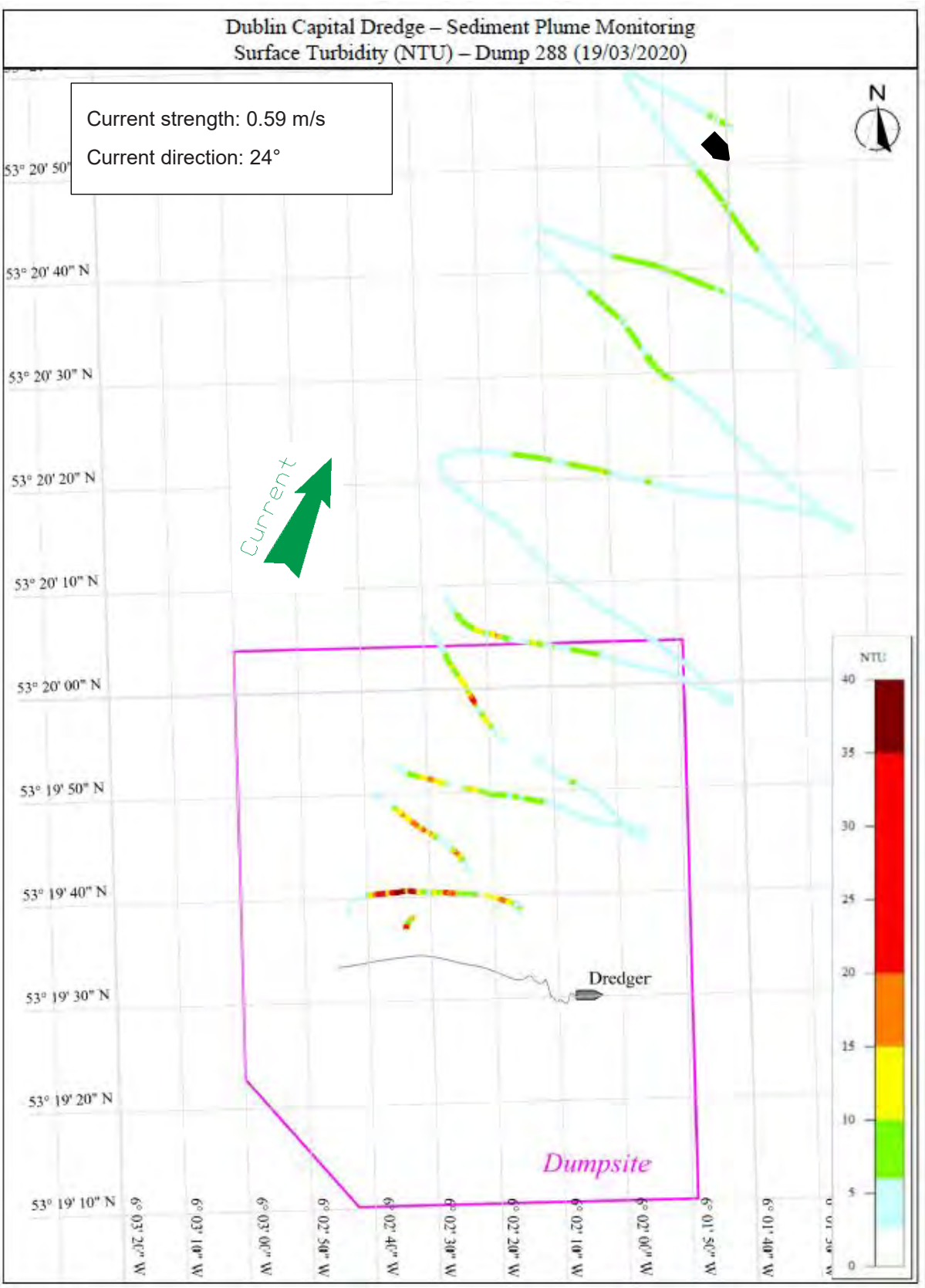


Figure 8.23: Dump 288 Survey track with surface turbidity [NTU]

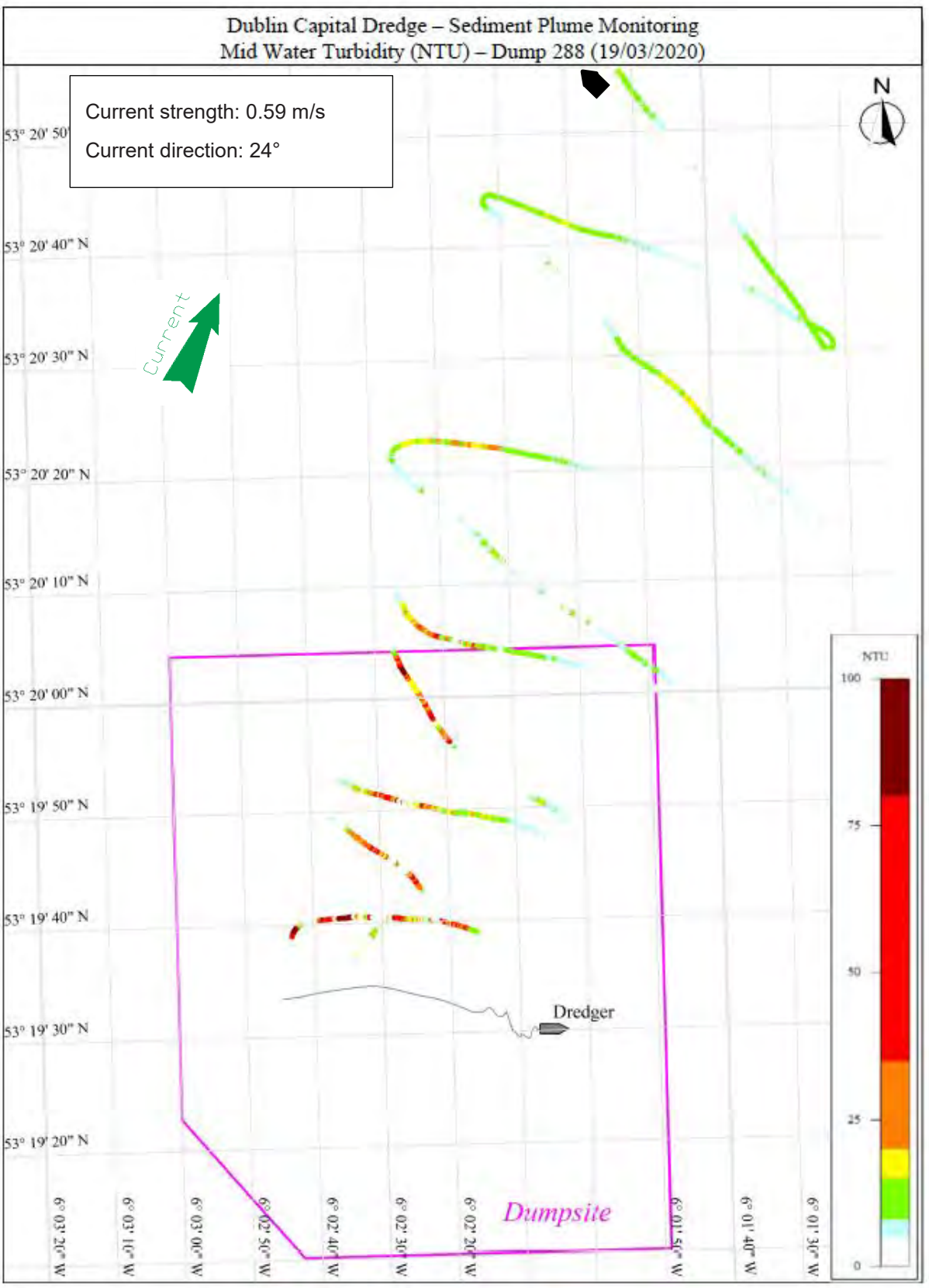
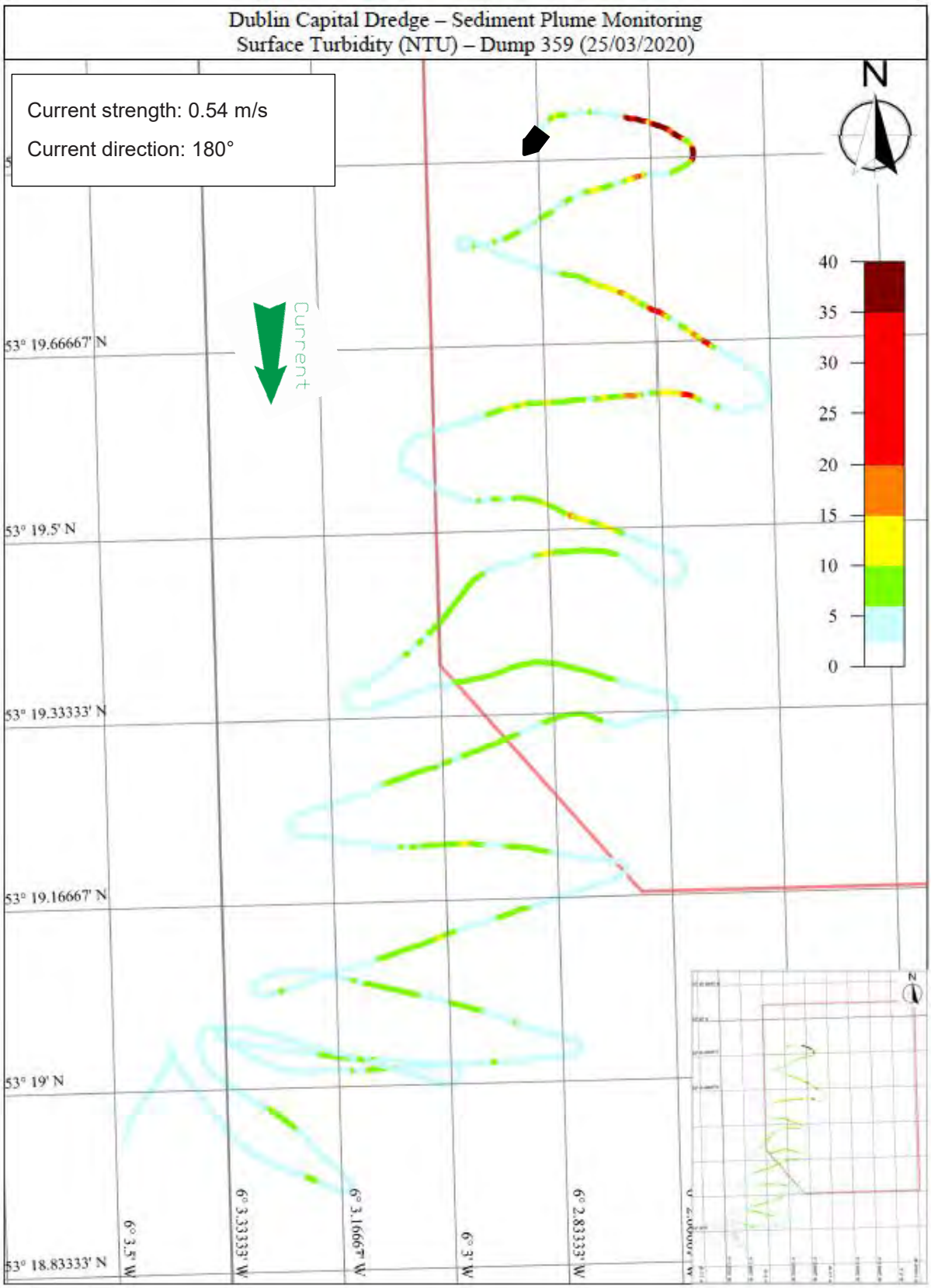


Figure 8.24: Dump 288 Survey track with mid water turbidity [NTU]



100

Figure 8.25: Dump 359 Survey track with surface turbidity [NTU]

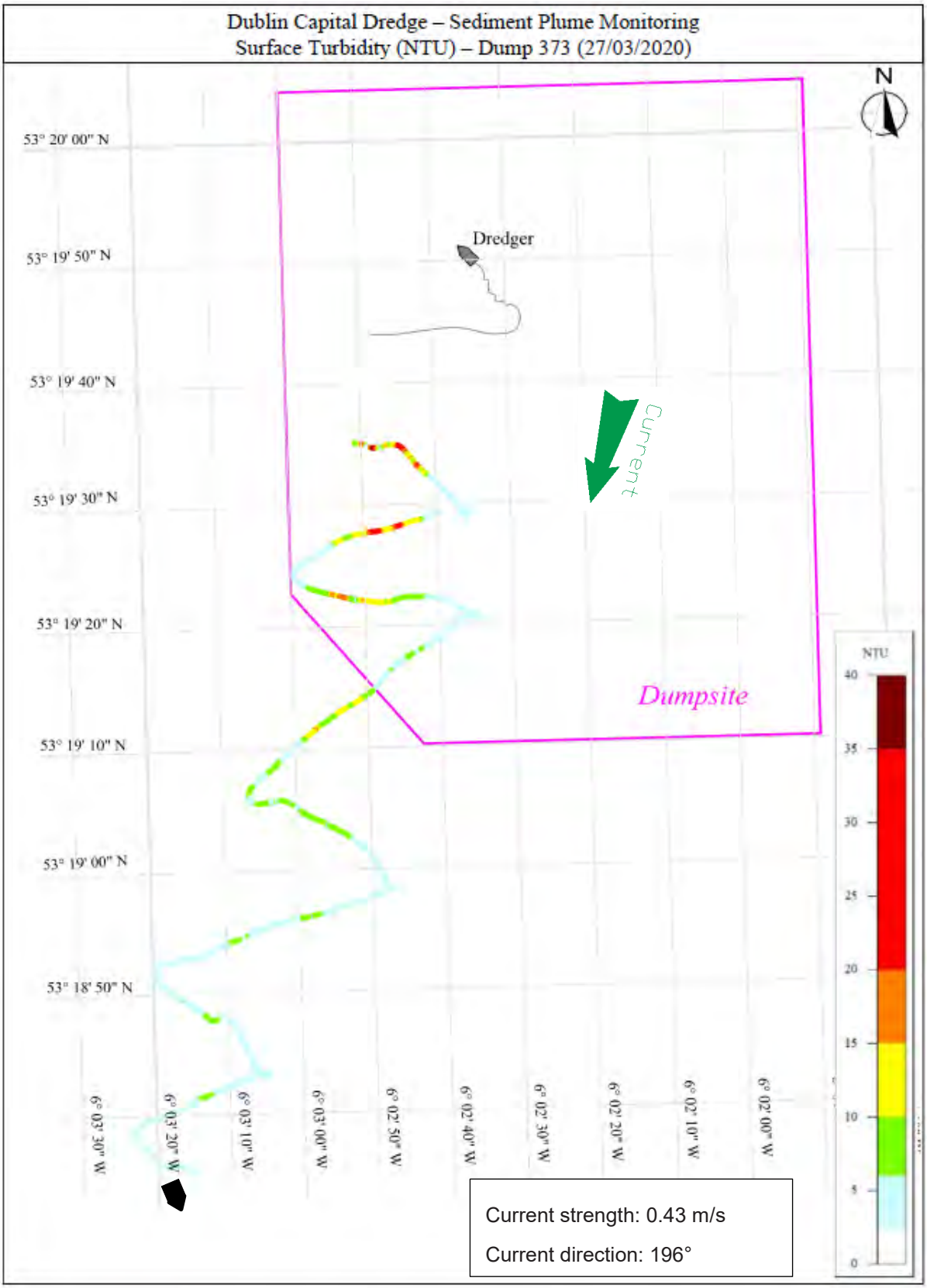


Figure 8.26: Dump 373 Survey track with surface turbidity [NTU]

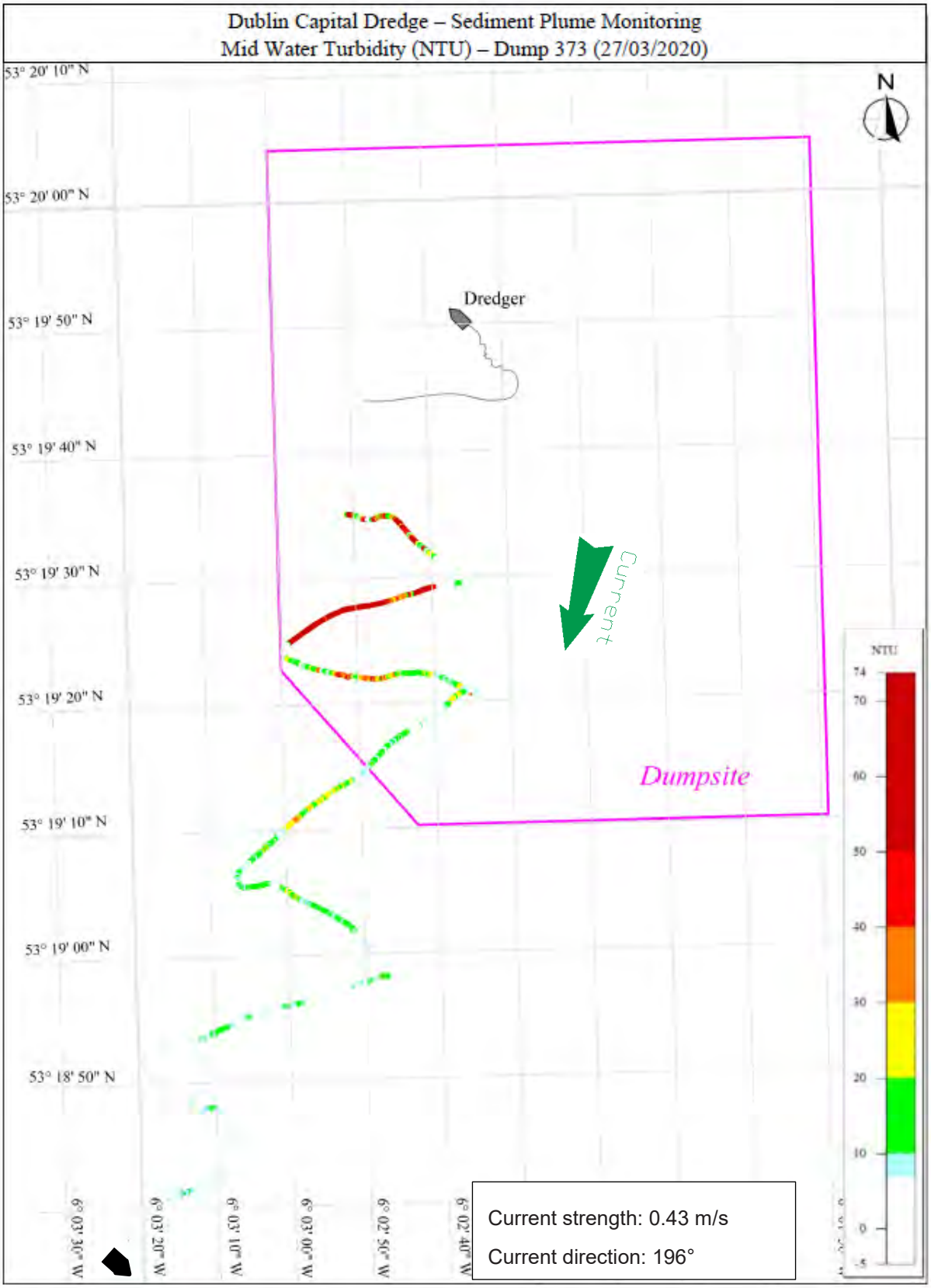


Figure 8.27: Dump 373 Survey track with mid water turbidity [NTU]

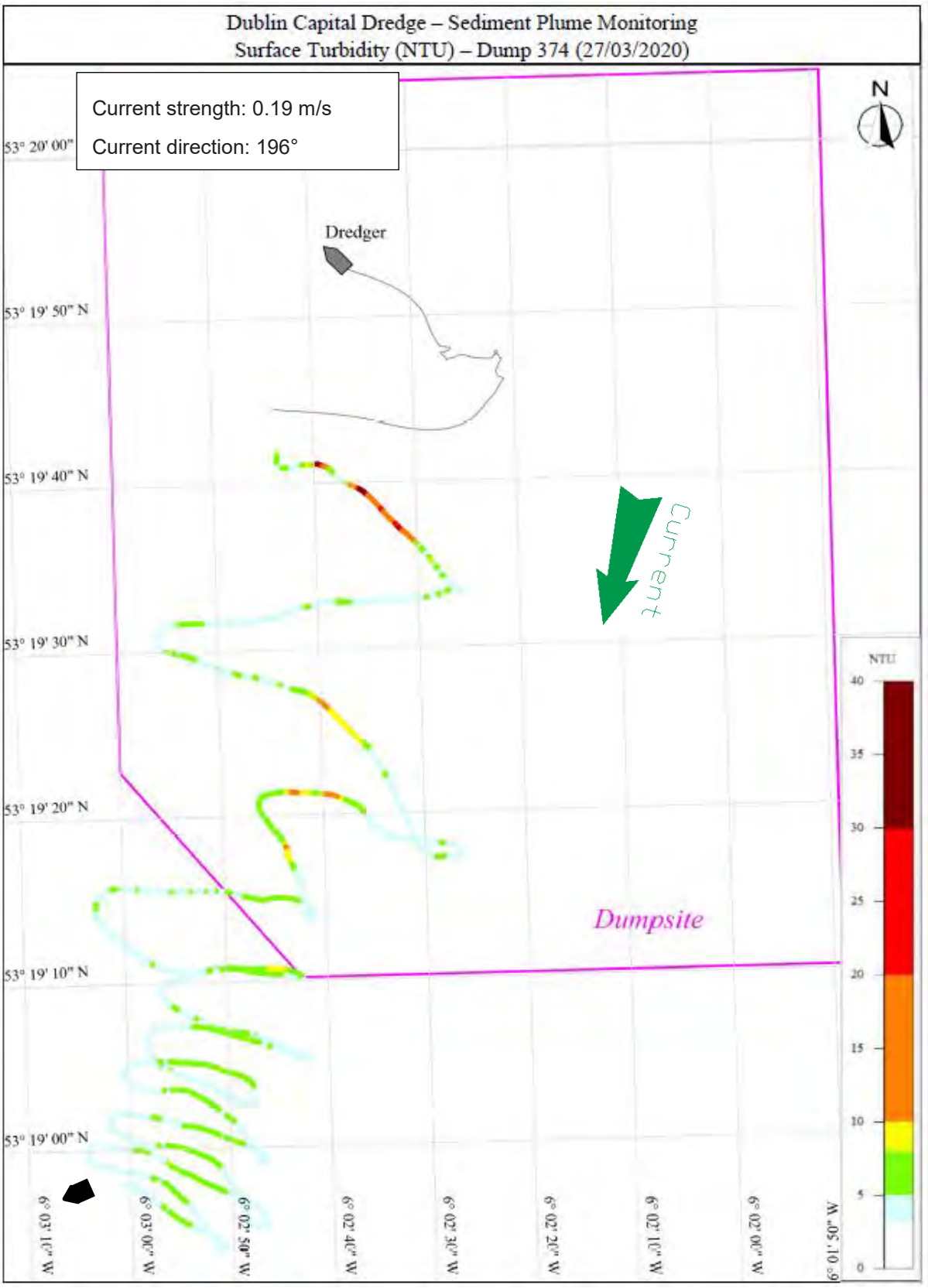


Figure 8.28: Dump 374 Survey track with surface turbidity [NTU]

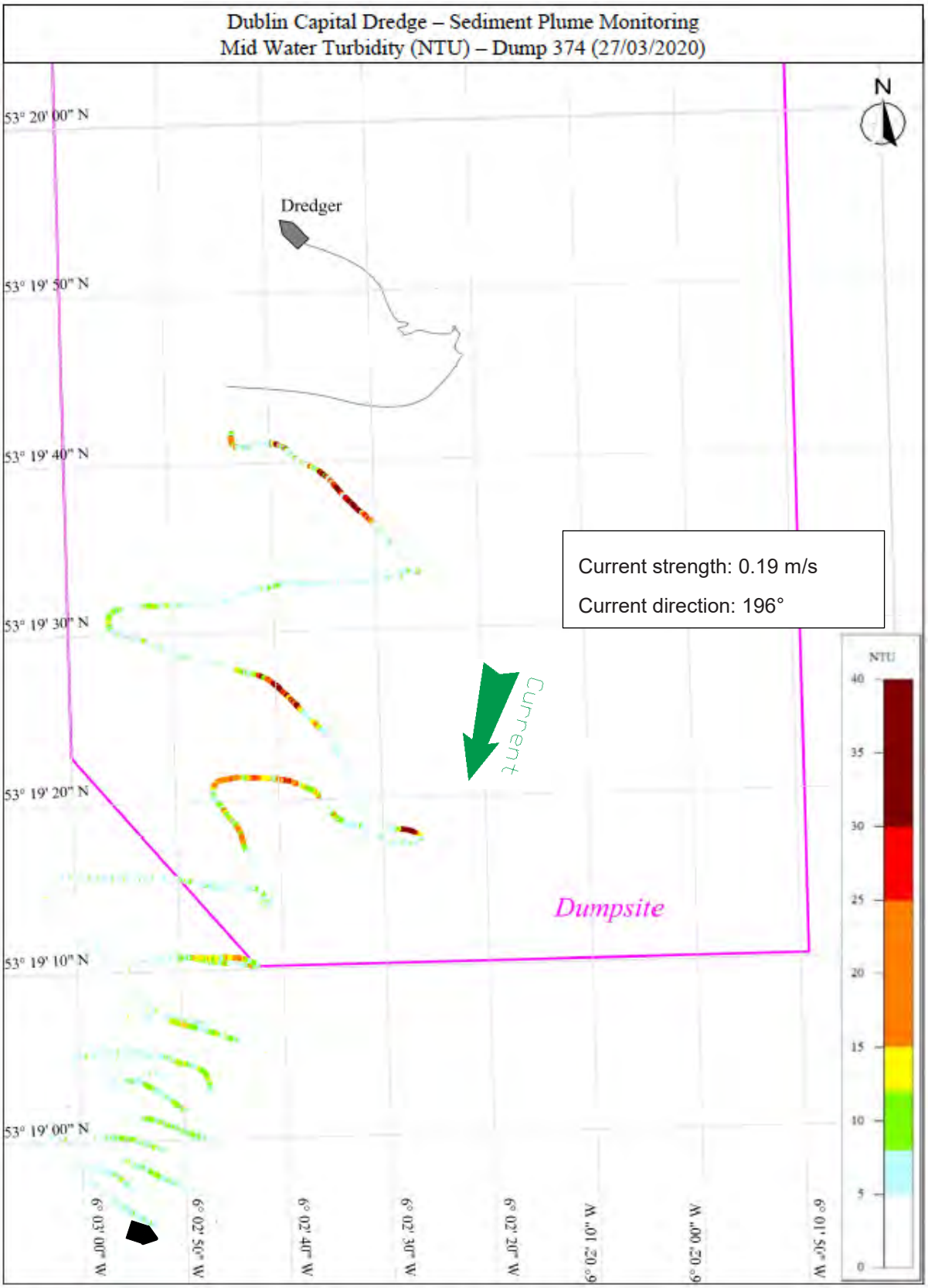


Figure 8.29: Dump 374 Survey track with mid water turbidity [NTU]

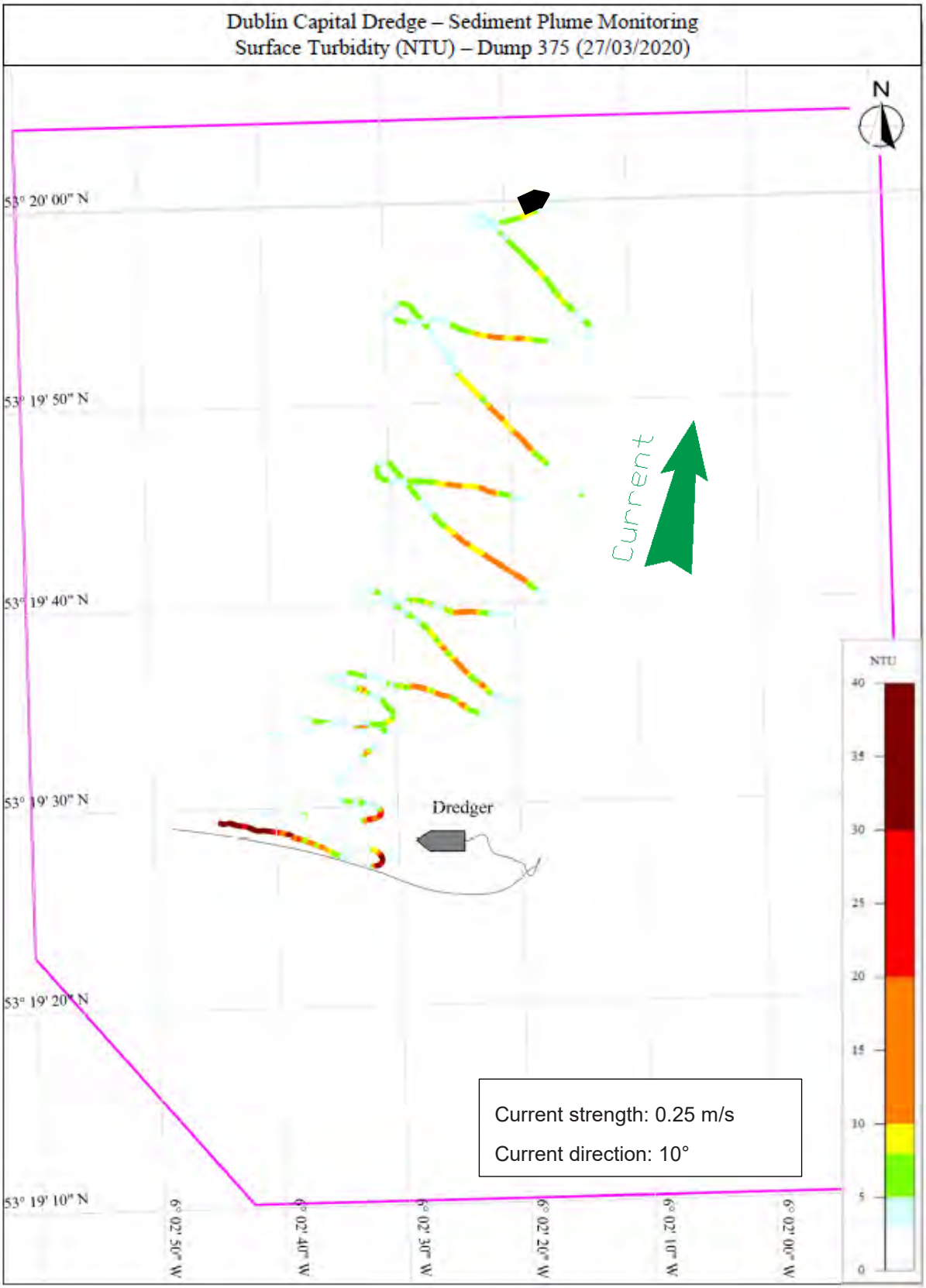


Figure 8.30: Dump 375 Survey track with surface turbidity [NTU]

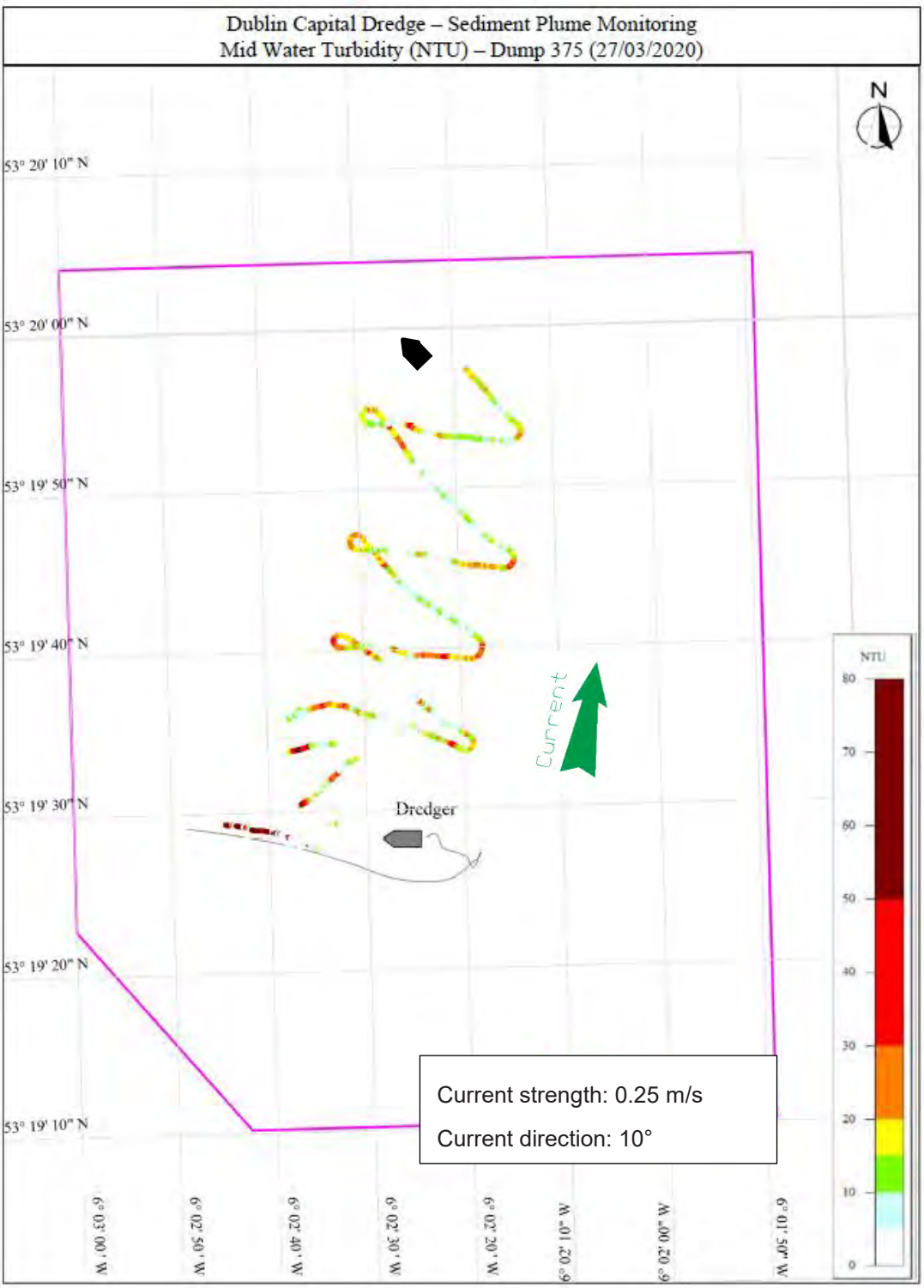


Figure 8.31: Dump 375 Survey track with mid water turbidity [NTU]

A.2 Comparison of Simulated and Recorded Data

In order to supplement the results presented in Section 6.1 and further validate the numerical modelling programme, RPS have produced 1D validation plots for all relevant dump events.

These plots illustrate the depth averaged simulated turbidity levels and actual turbidity levels recorded at the surface and mid-point of the water column as recorded by Hydromaster. It should be noted that each data in these plots have a unique spatial coordinate (i.e. as the survey vessel traversed the dump site) but this element has been omitted so data could be easily presented in one dimensional time series plots.

Table 8.1: Index of sediment plume validation plots for dump events 231 – 375

Date	Dump #	Figure No.
14/03/2020	231	Figure 8.32
16/03/2020	254	Figure 8.33
17/03/2020	266	Figure 8.34
	267	Figure 8.35
	268	Figure 8.36
18/03/2020	280	Figure 8.37
	281	Figure 8.38
	282	Figure 8.39
	283	Figure 8.40
27/03/2020	373	Figure 8.41
	374	Figure 8.42
	375	Figure 8.43

As demonstrated in Figure 8.32 to Figure 8.43, the computational models accurately simulate the temporal and spatial dispersion of sediment plumes during the dumping activities to a very high degree of accuracy.

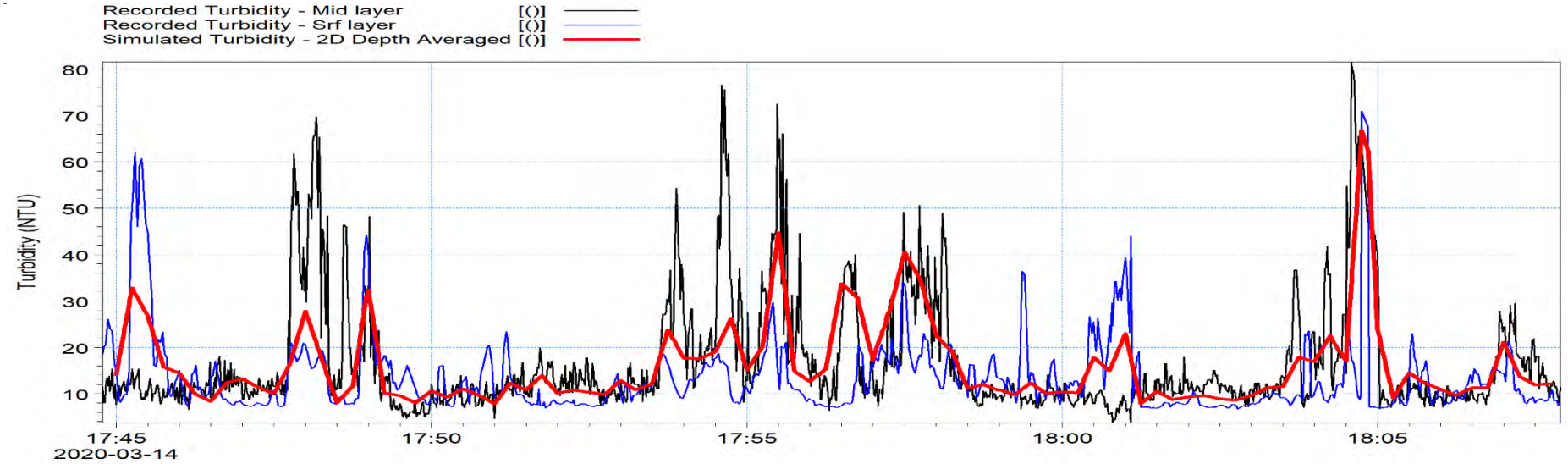


Figure 8.32: Comparison of recorded and simulated turbidity measurements across the dump site during Event 231

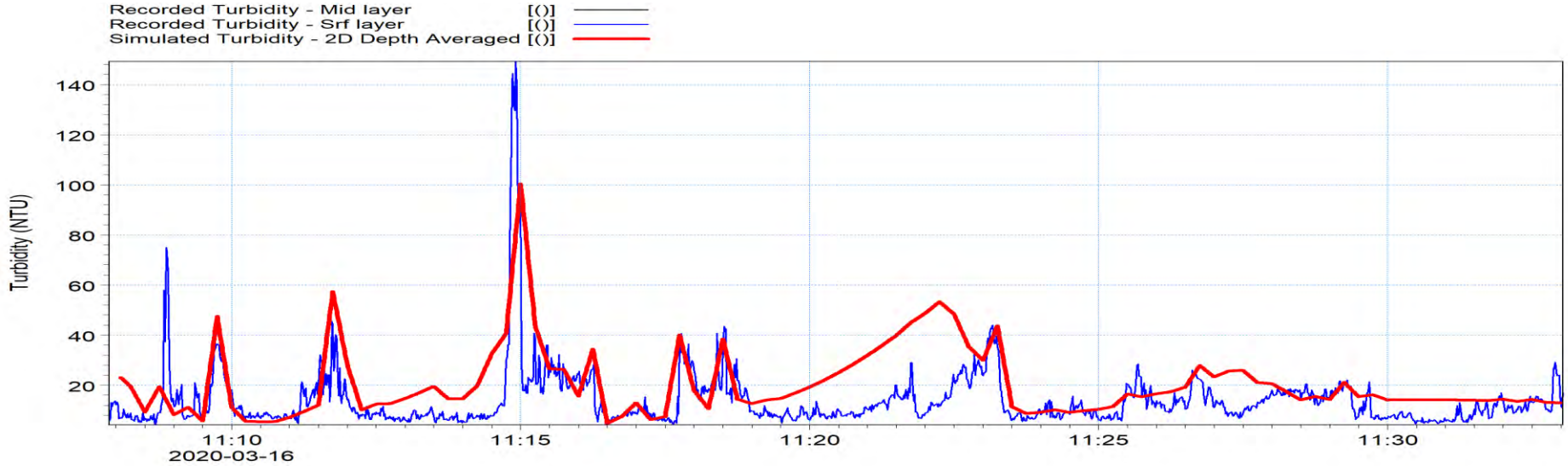


Figure 8.33: Comparison of recorded and simulated turbidity measurements across the dump site during Event 254

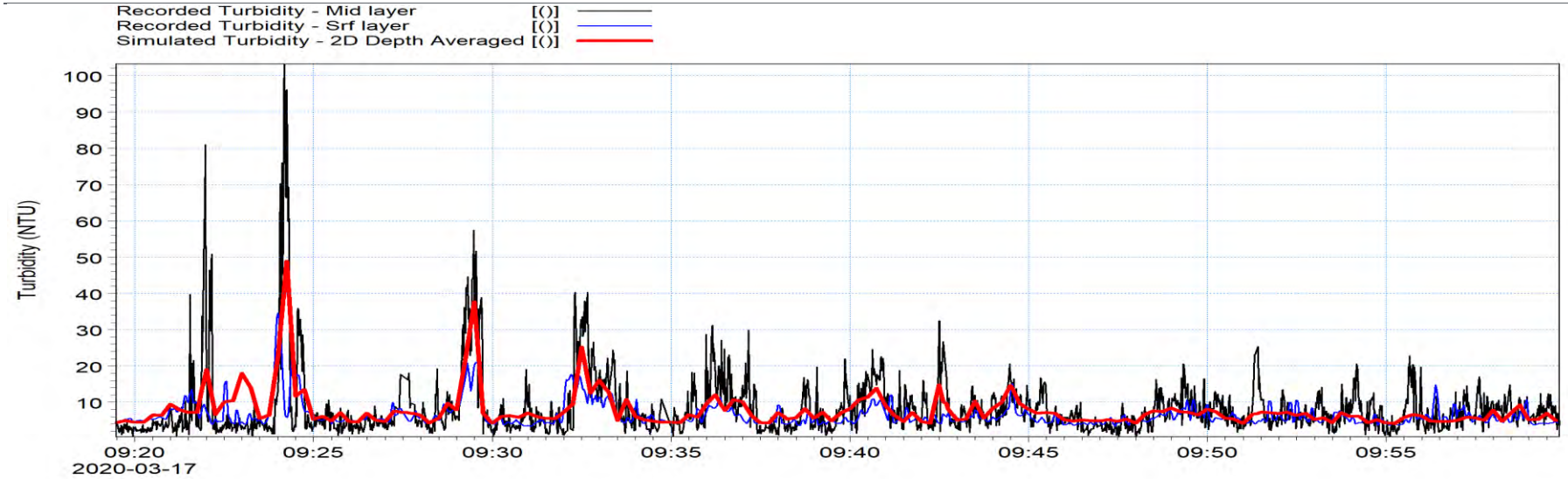


Figure 8.34: Comparison of recorded and simulated turbidity measurements across the dump site during Event 266

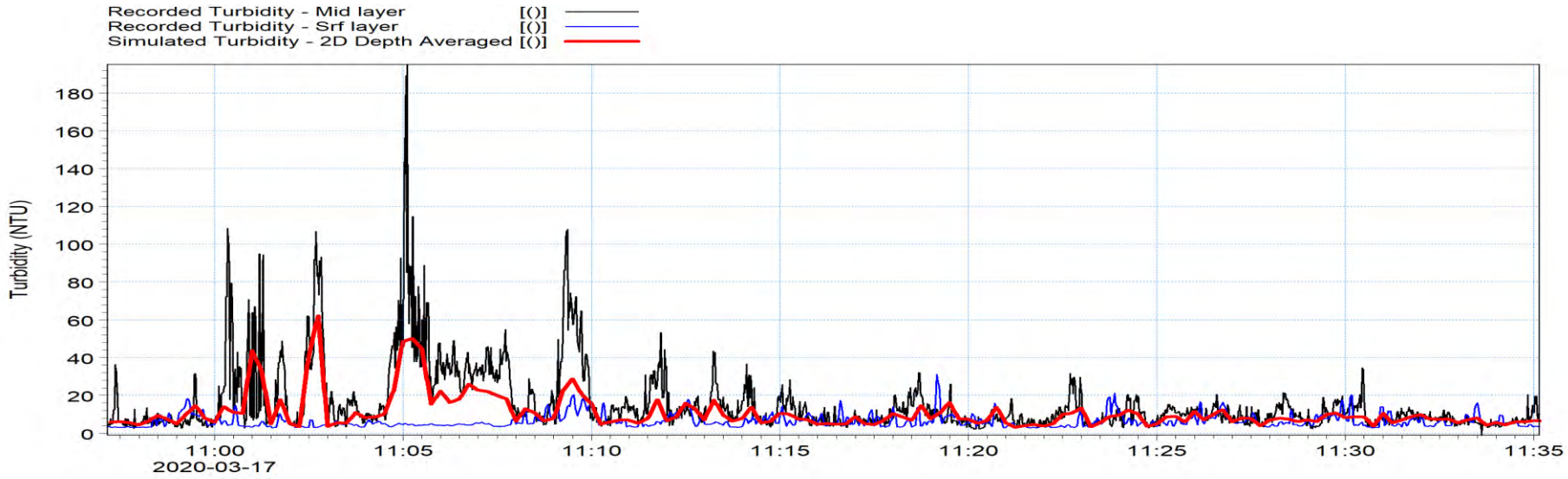


Figure 8.35: Comparison of recorded and simulated turbidity measurements across the dump site during Event 267

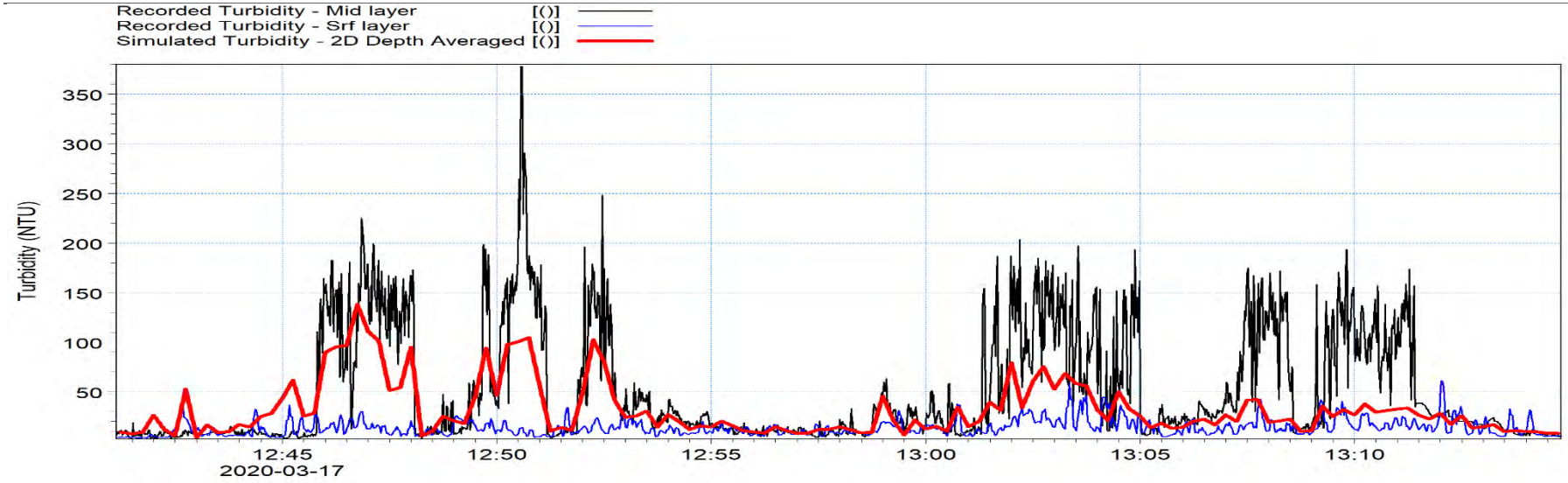


Figure 8.36: Comparison of recorded and simulated turbidity measurements across the dump site during Event 268

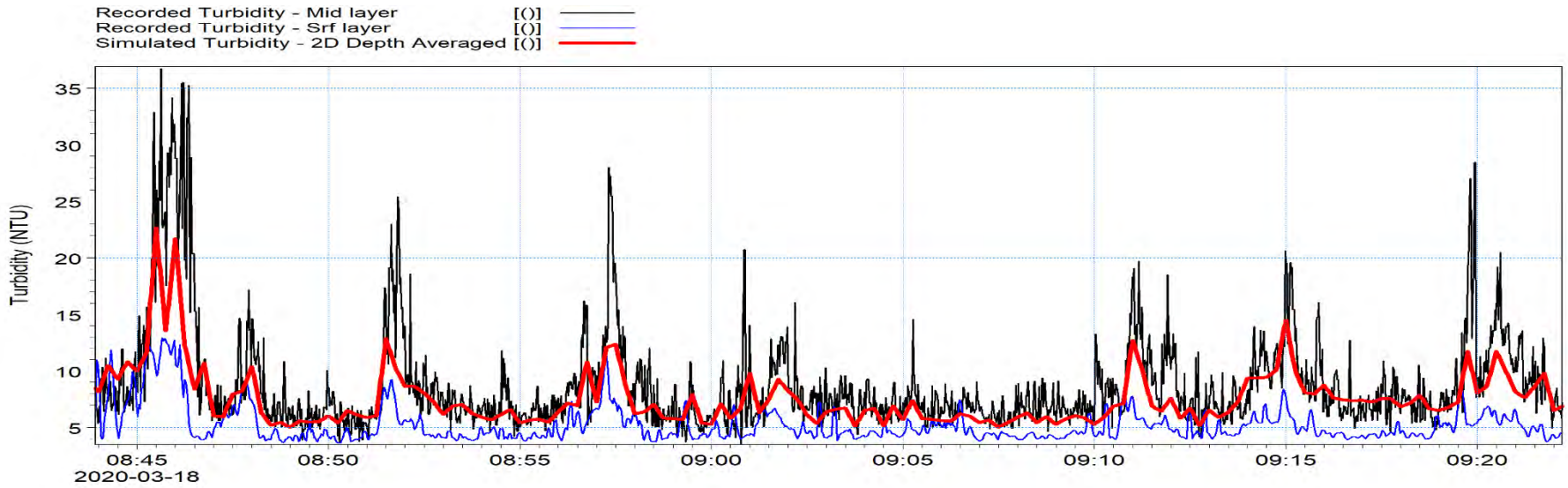


Figure 8.37: Comparison of recorded and simulated turbidity measurements across the dump site during Event 280

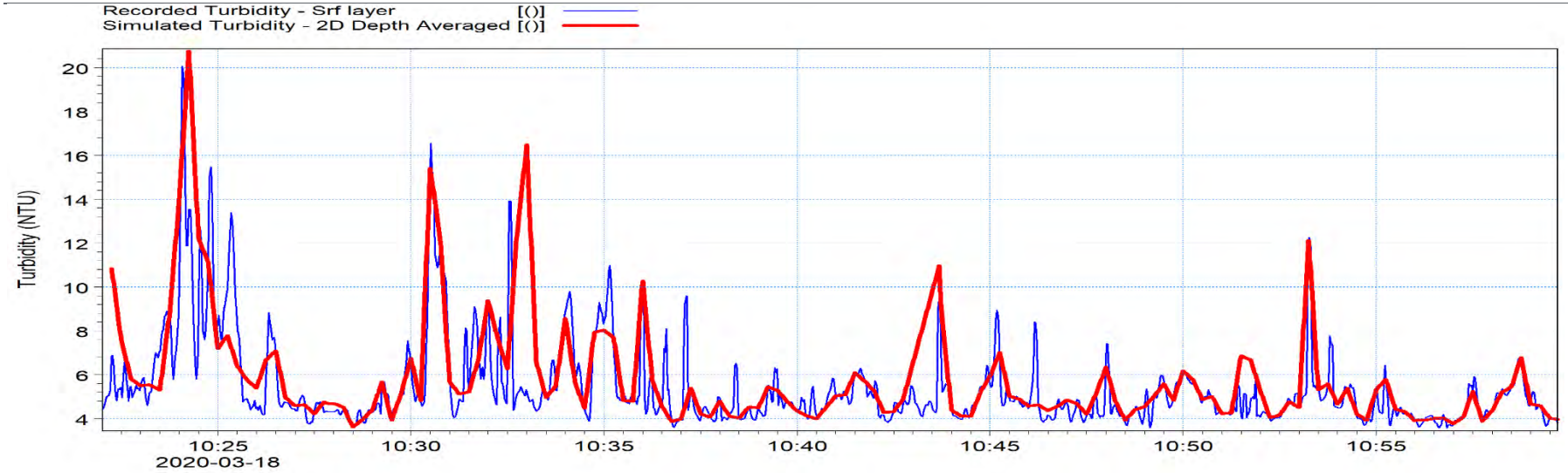


Figure 8.38: Comparison of recorded and simulated turbidity measurements across the dump site during Event 281

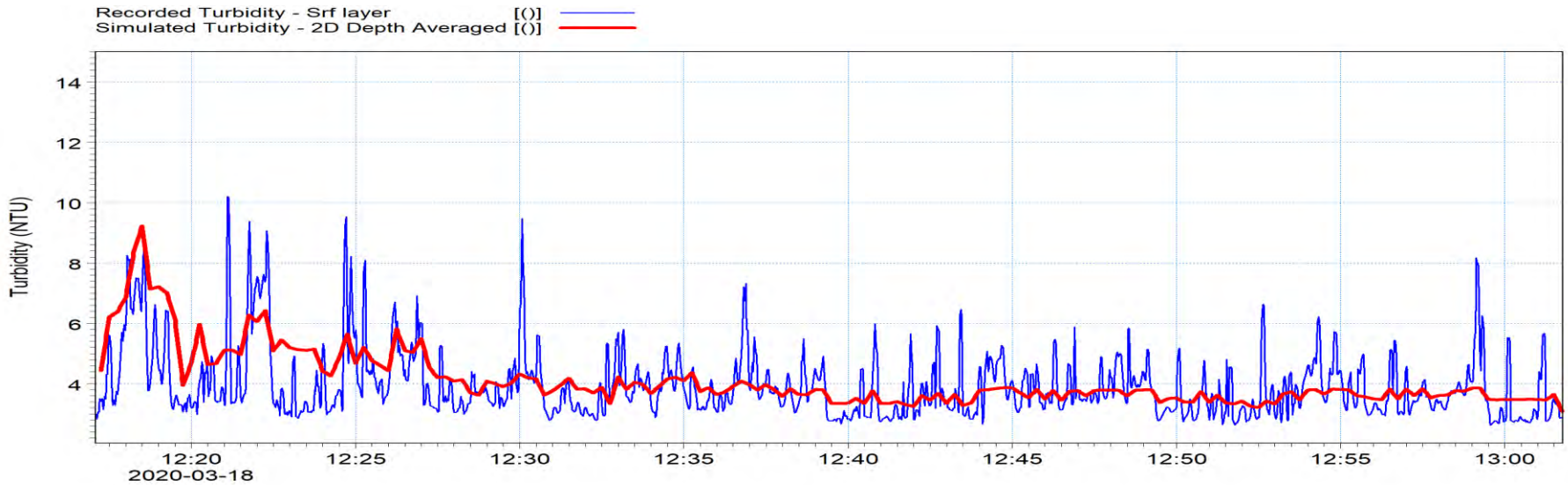


Figure 8.39: Comparison of recorded and simulated turbidity measurements across the dump site during Event 282

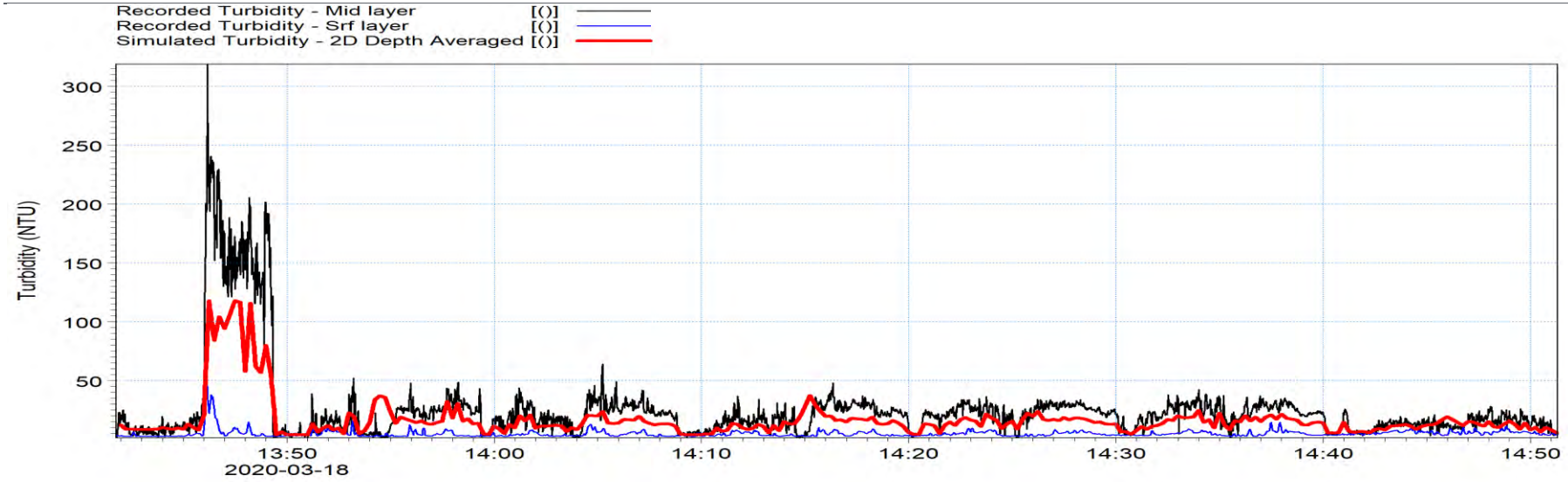


Figure 8.40: Comparison of recorded and simulated turbidity measurements across the dump site during Event 283

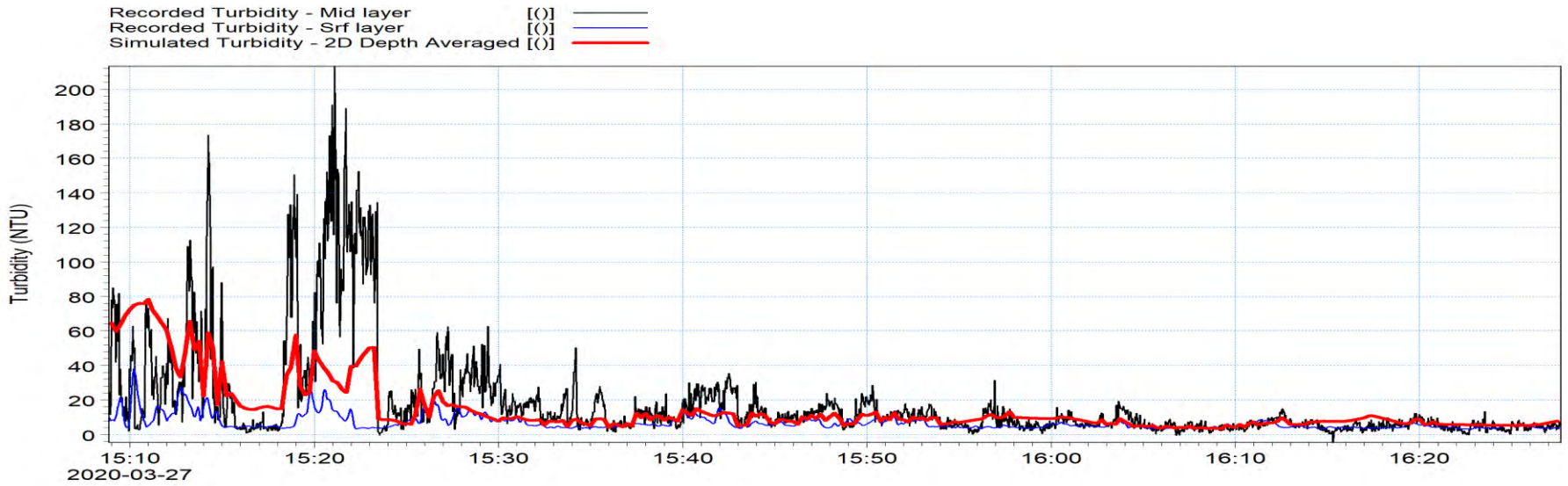


Figure 8.41: Comparison of recorded and simulated turbidity measurements across the dump site during Event 373

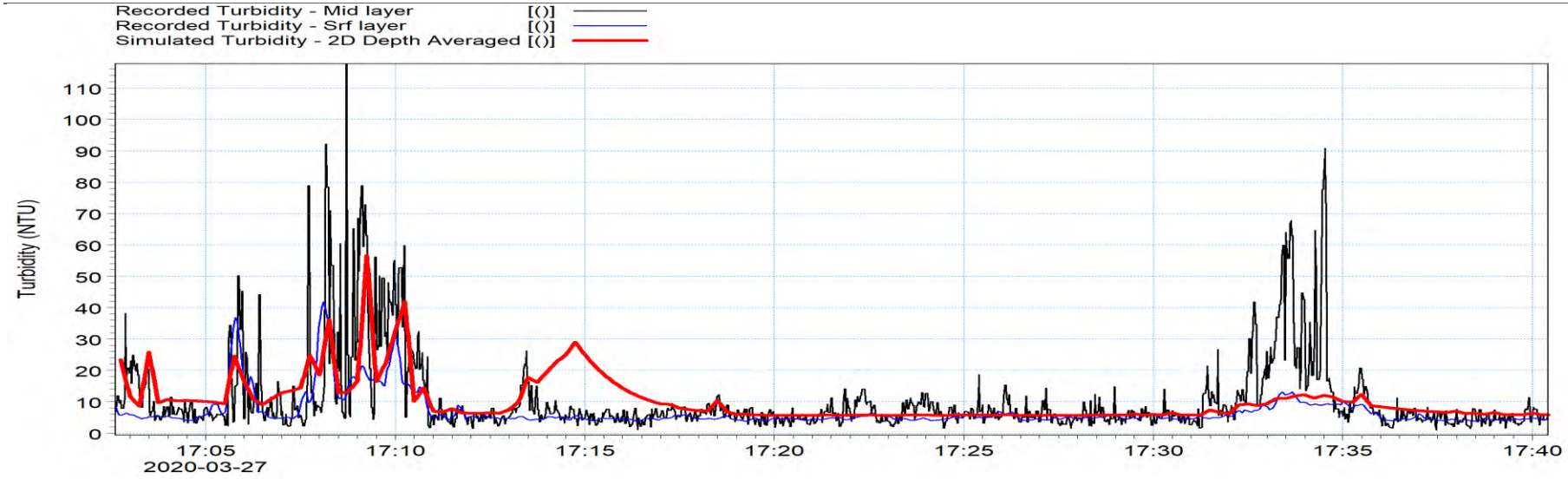


Figure 8.42: Comparison of recorded and simulated turbidity measurements across the dump site during Event 374

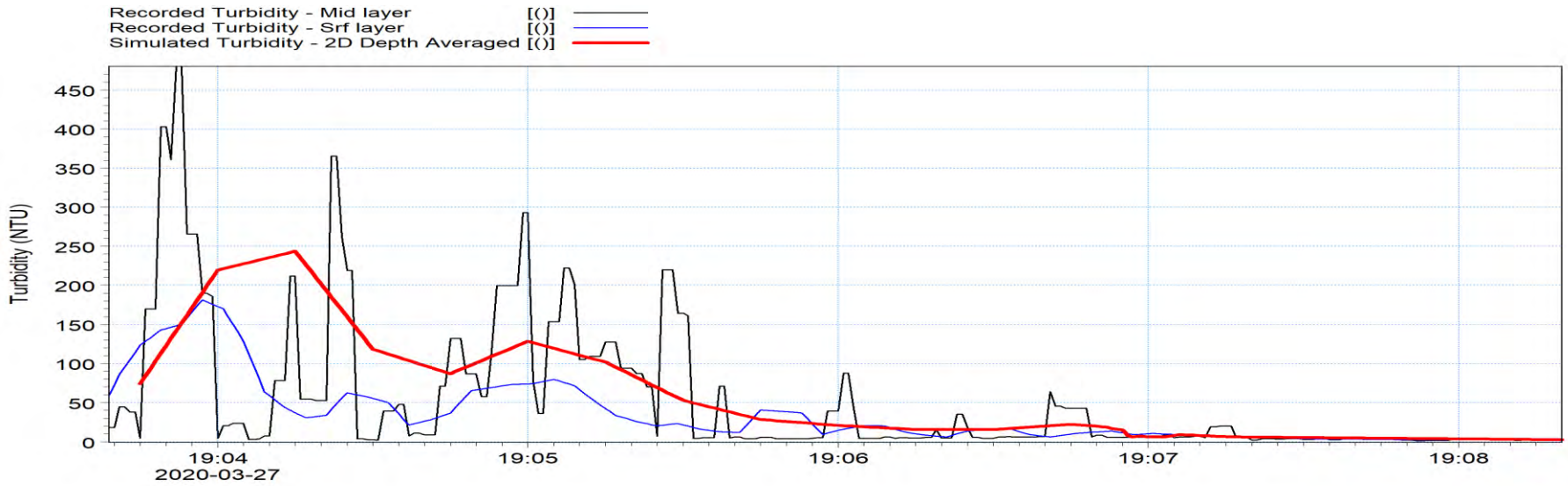


Figure 8.43: Comparison of recorded and simulated turbidity measurements across the dump site during Event 375

APPENDIX 5: DRAFT CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

Unchanged

APPENDIX 6: POOLBEG DISTURBANCE STUDY

new

ECOLOGICAL SURVEY FOR BIRDS

ESB Cooling Water Outfall, Poolbeg

NI1893 | Dublin Port Company
MP2 Project
Final
November 2019

www.rpsgroup.com

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1 INTRODUCTION

RPS was commissioned by Dublin Port Company to undertake an Ecological Survey for Birds at the ESB Power Station cooling water outfall adjacent to Poolbeg Tank Farm and the Great South Wall, Dublin Bay.

The purpose of these surveys was to record any disturbance events relevant to Special Conservation Interest species of South Dublin Bay and River Tolka Estuary Special Protection Area (SPA), observed by the ornithologist before, during and after dredging being carried out under Dumping at Sea Permit S0024-01 in the navigation channel in October 2019

1.1 Ecological Survey for Birds

The Ecological Survey Report has been written in accordance with the Chartered Institute of Ecological and Environmental Management (CIEEM) *Guidelines for Ecological Report Writing* (CIEEM 2017).

The aim of the report is to provide a description of the bird survey methods used and to provide the results of bird surveys; to inform an interpretation of the results by the appointed MP2 Project ornithologist.

2 METHODOLOGY

2.1 Statement of Authority

The ornithological surveyor and report author, Adam McClure BSc, is a Senior Ecologist with RPS with over 10 years of experience in the field of ornithology. Adam has extensive expertise and experience in conducting a wide range of ornithological surveys, including bird disturbance surveys. Adam is also a Full member of CIEEM and is currently a member of the CIEEM Irish Section Committee.

The second ornithological surveyor, Nick Veale BSc MSc, is an independent ecologist with over 18 years' experience in consulting ecology and specialising in ornithology. Nick has extensive expertise and experience in conducting a wide range of ornithological surveys, including bird disturbance surveys.

The information prepared and provided is true and accurate at the time of issue of this report and has been prepared and provided in accordance with the CIEEM Code of Professional Conduct (CIEEM, 2019).

We confirm that the professional judgement expressed herein is the true and bona fide opinion of our professional ecologists.

2.2 Consultation

As part of the planning application determination process, An Bord Pleanála received a submission from BirdWatch Ireland dated 6th September 2019.

BirdWatch Ireland raised concerns that the proposed dredging works to widen the current navigation channel could cause disturbance to an area which they identified as "a notable area for waterbirds", including "many gulls, but also smaller numbers of Sanderling, Black-tailed Godwits, Redshank and others".

The area in question is the cooling water outfall from ESB's Poolbeg Power Station located at the base of the Great South Wall in the Liffey Channel, where a small area of mudflat is exposed at low-tide.

BirdWatch Ireland noted that they were unable to discount the possibility of disturbance from dredging activities to Special Conservation Interest (SCI) species from neighbouring SPA sites, and in particular Black-headed Gull.

2.3 Disturbance Monitoring Survey

Permission has been granted under Dumping at Sea Permit S0024-01 to allow Dublin Port Company to dredge the navigation channel as part of Alexandra Basin Redevelopment

A dredging campaign was programmed for late October 2019 and a decision was taken to make use of that campaign as it presented an opportunity to capture any disturbance events that might occur when the permitted dredging activity was taking place.

In order to assess potential disturbance events caused by the presence of the dredging vessel, suitable vantage points overseeing the outfall and surrounding lands were established.

The dredging vessel, Freeway, is a 92m hopper dredger. During monitoring the dredger slowly passed by the survey area at the inner limit of the dredging area, approximately 200m from shore, or approximately 150m from the low water mark. During operation, the dredger was passing the survey area for 10-15 minutes.

A vantage point (VP), located on the southern bank of the Liffey, on the quayside adjacent to Poolbeg Tank Farm was chosen.

Due to restrictions on access over a bank holiday weekend, a second vantage point was required. The second VP was located on reclaimed land adjacent to Terminal 5 on the northern bank of the Liffey (Figure 1.0).

Figure 1.0 – Showing location of vantage points and area of interest

Vantage point watches were conducted within a window, +/- 2.5 hours either side of low water on days where day light permitted.

Observers recorded all disturbance events during surveys, including potential disturbance events, noting the species and numbers present and their reaction to the disturbance event.

In order to provide a series of control observations, surveys were conducted over several days prior to the dredger moving into the area, as well as during dredging activities and after dredging activities had ceased.

The response of waterbirds present was assigned a score on a scale from 0 to 3:

- 0 - No behavioural change
- 1 - Behavioural change (e.g. vigilance or alarm call) but not flight
- 2 - Flew but soon returned to the site
- 3 - Flew and abandoned the site

3 RESULTS

3.1 Disturbance Monitoring Survey

A total of 24 hours and 40 minutes of survey were carried out over six days between 22nd October and 27th October 2019 (see Table 3.2).

Full results of disturbance events are presented as Appendix 2. A summary is presented below.

Observers recorded 100 events which had the potential to cause disturbance, mostly passing ships entering or leaving Dublin Port.

Eighty-two events did not cause any behavioural change in any of the birds present within the survey area (see Table 3.1).

The presence of the dredger, both during operation or when passing the survey area, did not cause any behavioural change in any of the birds present onsite.

Table 3.1 – Disturbance events recorded and levels of severity

Severity level	0	1	2	3	Total
No. of disturbance events	82	11	5	2	100

Eighteen disturbance events resulted in behavioural change:

- Eleven events, all caused by small wakes produced by passing ships, resulted in behavioural change (e.g. vigilance or alarm call) but not flight
- Five events, all caused by potentially predatory birds flying over, resulted in some of the birds present taking flight, but they soon returned to the site; and
- Two events, both caused by wakes produced by the Dublin Port Authority pilot vessel passing at speed, resulted in some of the birds present taking flight and not returning.

Table 3.2 – Conditions during survey

Date	Observer	VP	Control / Dredging	Start	End	Tide	Sunrise / Sunset	Cloud (Oktas)	Visibility (Met Eireann, 2019)	Wind (Beaufort scale)	Temp. (°C)	Precipitation
22.10.2019	AM	Poolbeg	Control	10:15	14:15	12:18	n/a	8/8	Excellent	1 SW	10	None
23.10.2019	NV	Poolbeg	Control	11:30	16:00	13:41	n/a	6/8	Very good	3-4 SW	13	None
24.10.2019	NV	Poolbeg	Dredging	12:10	16:50	14:50	18:09	2/8	Very good	4-5 NW	12	None
25.10.2019	AM	Poolbeg	Dredging	13:45	14:45	15:45	18:07	8/8	Moderate	2-3 SW	6	Rain throughout
		Terminal 5		15:15	17:45							
26.10.2019	AM	Terminal 5	Dredging	14:00	17:30	16:30	18:05	3/8	Excellent	3 SW	7	None
27.10.2019	NV	Terminal 5	Dredging	14:00	18:00	16:15	17:03	0/8	Excellent	1-2 NW	10-3	None

REFERENCES

CIEEM (2017) *Guidelines for Ecological Report Writing*, Chartered Institute of Ecology and Environmental Management, Winchester.

CIEEM (2019) *Code of Professional Conduct*, Chartered Institute of Ecology and Environmental Management, Winchester.

Cutts, N.D., Phelps, A., & Burdon, D. (2009) *Construction and waterfowl: Defining sensitivity, response, impacts and guidance.* Report to Humber INCA. Institute of Estuarine & Coastal Studies, University of Hull.

Davidson, N.C. and Rothwell, P.I. (1993) Human disturbance to waterfowl on esturies: conservation and coastal management implications of current knowledge. *Wader Study Group Bulletin* 68: 97-105.

Goss-Custard, J.D., Triplet, P., Sueur, F., and West, A.D. (2006) Critical thresholds of disturbance by people and raptors in wading birds. *Biological Conservation* 127, pp. 88-97.

Goss-Custard, J.D., Hoppe, C.H., Hood, M.J. and Stillman, R.A. (2019) Disturbance does not have a significant impact on waders in an estuary close to conurbations: importance of overlap between birds and people in time and space. Ibis. doi:10.1111/ibi.12769

Hill, D., Hockin, D., Price, D., Tuckers, G., Morris, R. and Treweek, J. (1997) Bird disturbance: improving the quality and utility of disturbance research. *Journal of Applied Ecology* 34: 275-288.

Marsden, S.J. (2000) Impact of Disturbance on Waterfowl Wintering in a UK Dockland Redevelopment Area. *Environmental Management* Vo. 26, No. 2, pp. 207-2013.

Met Eireann (2019) Sea Area Forecast Terminology, [online]. Available at: https://www.met.ie/forecasts/marine-inland-lakes/sea-area-forecast-terminology [Accessed: 23 October 2019)

Phalan, B. and Nairn, R.G.W. (2007) Disturbance to waterbirds in South Dublin Bay. *Irish Birds* 8: 223-230.

Smit, C.J., & Visser, J.M., 1993. Effects of disturbance on shorebirds: a summary of the existing knowledge from the Dutch Wadden Sea and Delta area. *Wader Study Group Bulletin*, 68, pp. 6-19.

Appendices

Appendix 1 - BTO Species Codes

BTO SPECIES CODES

AC	Arctic Skua	GA	Godwall	LE	Long-eared Owl	SM	Sand Martin
AE	Arctic Tern	GX	Gannet	LT	Long-tailed Tit	SS	Sanderling
AV	Avocet	GW	Garden Warbler	MG	Magpie	TE	Sandwich Tern
BO	Barn Owl	GY	Garganey	MA	Mallard	VI	Savi's Warbler
BY	Barnacle Goose	GC	Goldcrest	MN	Mandarin Duck	SQ	Scarlet Rosefinch
BA	Bar-tailed Godwit	EA	Golden Eagle	MX	Manx Shearwater	SP	Scaup
BR	Bearded Tit	OL	Golden Oriole	MR	Marsh Harrier	CY	Scottish Crossbill
BS	Berwick's Swan	GF	Golden Pheasant	MT	Marsh Tit	SW	Sedge Warbler
BI	Bittern	GP	Golden Plover	MW	Marsh Warbler	NS	Serin
BK	Black Grouse	GN	Goldeneye	MP	Meadow Pipit	SA	Shag
TY	Black Guillemot	GO	Goldfinch	MU	Mediterranean Gull	SU	Shelduck
BX	Black Redstart	GD	Goosander	ML	Merlin	SX	Shorelark
BJ	Black Tern	GI	Goshawk	M.	Mistle Thrush	SE	Short-eared Owl
B.	Blackbird	GH	Grasshopper Warbler	MO	Montagu's Harrier	SV	Shoveler
BC	Blackcap	GB	Great Black-backed Gull	MH	Moorhen	SK	Siskin
BH	Black-headed Gull	GG	Great Crested Grebe	MS	Mute Swan	S.	Skylark
BN	Black-necked Grebe	ND	Great Northern Diver	N.	Nightingale	SZ	Slavonian Grebe
BW	Black-tailed Godwit	NX	Great Skua	NJ	Nightjar	SN	Snipe
BV	Black-throated Diver	GS	Great Spotted Woodpecker	NH	Nuthatch	SB	Snow Bunting
BT	Blue Tit	GT	Great Tit	OP	Osprey	ST	Song Thrush
BU	Bluethroat	GE	Green Sandpiper	OC	Oystercatcher	SH	Sparrowhawk
BL	Brambling	G.	Green Woodpecker	PX	Peafowl/Peacock	AK	Spotted Crake
BG	Brent Goose	GR	Greenfinch	PE	Peregrine	SF	Spotted Flycatcher
BF	Bullfinch	GK	Greenshank	PH	Pheasant	DR	Spotted Redshank
BZ	Buzzard	H.	Grey Heron	PF	Pied Flycatcher	SG	Starling
CG	Canada Goose	P.	Grey Partridge	PW	Pied Wagtail	SD	Stock Dove
CP	Capercaillie	GV	Grey Plover	PG	Pink-footed Goose	SC	Stonechat
C.	Carrion Crow	GL	Grey Wagtail	PT	Pintail	TN	Stone-curlew
CW	Cetti's Warbler	GJ	Greylag Goose	PO	Pochard	TM	Storm Petrel
CH	Chaffinch	GU	Guillemot	PM	Ptarmigan	SL	Swallow
CC	Chiffchaff	FW	Guineafowl (Helmeted)	PU	Puffin	SI	Swift
CF	Chough	HF	Hawfinch	PS	Purple Sandpiper	TO	Tawny Owl
CL	Cirl Bunting	HH	Hen Harrier	Q.	Quail	T.	Teal
CT	Coal Tit	HG	Herring Gull	RN	Raven	TK	Temminck's Stint
CD	Collared Dove	HY	Hobby	RA	Razorbill	TP	Tree Pipit
CM	Common Gull	HZ	Honey Buzzard	RG	Red Grouse	TS	Tree Sparrow
CS	Common Sandpiper	HC	Hooded Crow	KT	Red Kite	TC	Treecreeper
CX	Common Scoter	HP	Hoopoe	ED	Red-backed Shrike	TU	Tufted Duck
CN	Common Tern	HM	House Martin	RM	Red-breasted Merganser	TT	Turnstone
CO	Coot	HS	House Sparrow	RQ	Red-crested Pochard	TD	Turtle Dove
CA	Cormorant	JD	Jackdaw	FV	Red-footed Falcon	TW	Twite
CB	Corn Bunting	J.	Jay	RL	Red-legged Partridge	WA	Water Rail
CE	Corncrake	K.	Kestrel	NK	Red-necked Phalarope	W.	Wheatear
CI	Crested Tit	KF	Kingfisher	LR	Redpoll (Lesser)	WM	Whimbrel
CR	Crossbill (Common)	KI	Kittiwake	RK	Redshank	WC	Whinchat
CK	Cuckoo	KN	Knot	RT	Redstart	WG	White-fronted Goose
CU	Curlew	LM	Lady Amherst's Pheasant	RH	Red-throated Diver	WH	Whitethroat
DW	Dartford Warbler	LA	Lapland Bunting	RE	Redwing	WS	Whooper Swan
DI	Dipper	L.	Lapwing	RB	Reed Bunting	WN	Wigeon
DO	Dotterel	TL	Leach's Petrel	RW	Reed Warbler	WT	Willow Tit
DN	Dunlin	LB	Lesser Black-backed Gull	RZ	Ring Ouzel	WW	Willow Warbler
D.	Dunnock	LS	Lesser Spotted Woodpecker	RP	Ringed Plover	OD	Wood Sandpiper
EG	Egyptian Goose	LW	Lesser Whitethroat	RI	Ring-necked Parakeet	WO	Wood Warbler
E.	Eider	LI	Linnet	R.	Robin	WK	Woodcock
FP	Feral Pigeon	ET	Little Egret	DV	Rock Dove (not feral)	WL	Woodlark
ZL	Feral/hybrid goose	LG	Little Grebe	RC	Rock Pipit	WP	Woodpigeon
ZF	Feral/hybrid mallard type	LU	Little Gull	RO	Rook	WR	Wren
FF	Fieldfare	LO	Little Owl	RS	Roseate Tern	WY	Wryneck
FC	Firecrest	LP	Little Ringed Plover	RY	Ruddy Duck	YW	Yellow Wagtail
F.	Fulmar	AF	Little Tern	RU	Ruff	Y.	Yellowhammer

Appendix 2 - Full results from disturbance survey

Date	Time	Tide	Species and number present	Disturbance Event	Severity
22/10/219	10:20	M-L falling	260 BH, 4 CA, 6 HG, 1 OC, 2 TT, 2 RK	Small survey boat passing inside bouy	0
22/10/219	10:36	M-L falling	2 BW, 3 RK, 260 BH, 4 CA, 6 HG, 2 TT	Rib passing inside bouy	0
22/10/219	10:46	M-L falling	2 BW, 3 RK, 260 BH, 4 CA, 6 HG, 2 TT	Rib passing inside bouy	0
22/10/219	10:58	M-L falling	2 BW, 3 RK, 260 BH, 4 CA, 6 HG, 2 TT	Freight Craft "Mistral"	0
22/10/219	11:09	M-L falling	3 RK, 9 BG, 12 HG, 280 BH	Rosbeg workboat passing	0
22/10/219	11:16	M-L falling	3 RK, 9 BG, 12 HG, 280 BH	Ship Irish Ferries "WB Yeats" temporary wake surge	0
22/10/219	11:42	M-L falling	16 HG, 1 GB, 2 BW, 6 TT, 2 RK, 330 BH, 2 CA	Buzzard flying over, being mobbed by 2 Hooded Crows	2
22/10/219	11:46	M-L falling	16 HG, 1 GB, 2 BW, 6 TT, 2 RK, 330 BH, 2 CA	Kestrel flying over	2
22/10/219	12:02	Low	1 RK, 3 CA, 4 HG, 6 TT, 350 BH	Stena Superfast ferry and small rib passing	0
22/10/219	12:11	Low	1 RK, 3 CA, 4 HG, 6 TT, 350 BH	Seatruck	0
22/10/219	13:06	L-M rising	2 CA, 3 TT, 1 RK, 150 BH	Heron flying in	0
22/10/219	13:06	L-M rising	200 BH, 9 HG	Heron flying in	2
22/10/219	13:18	L-M rising	9 HG, 2 CA, 3 TT, 1 RK, 350 BH	Ferry passing	0
22/10/219	13:37	L-M rising	6 HG, 1 RK, 1 TT, 300 BH	Ferry passing	0
22/10/219	13:41	L-M rising	6 HG, 1 RK, 1 TT, 300 BH	Dublin Port pilot boat passing causing small wake	0
23/10/2019	11:41	M-L falling	213 BH, 23 HG, 2 MU, 7 GB, 4 OC, 16 TT, 2 L, 6 RK,	Rosbeg tug 140m from Quay working and making manoeuvres	0
23/10/2019	12:02	M-L falling	236 BH, 15 HG, 3 MU, 4 GB, 2 OC, 22 TT, 9 RK,	Stena Superfast Passenger ferry	0
23/10/2019	12:13	M-L falling	265 BH, 11 HG, 4 MU, 6 GB, 4 OC, 16 TT, 7 RK, 2 CA, 1 H.	Seatruck	0
23/10/2019	12:28	M-L falling	305 BH, 14 HG, 3 MU, 8 GB, 2 OC, 10 TT, 16 RK, 4 CA, 2 H, 1 GG	Celtic Explorer	0
23/10/2019	12:49	M-L falling	360 BH, 10 HG, 2 MU, 7 GB, 5 OC, 19 TT, 6 RK, 13 CA, 3 H, 2 GG	Small Craft Boksalis RIB Escorting Dredger out at	0
23/10/2019	13:23	M-L falling	350 BH, 10 HG, 2 MU, 7 GB, 5 OC, 19 TT, 6 RK, 13 CA, 3 H, 2 GG	Freight Craft "WithDAWN"	0
23/10/2019	13:33	M-L falling	280 BH, 7 HG, 1 MU, 8 GB, 4 OC, 16 TT, 9 RK, 15 CA, 2 H,	Small Craft dublin pilot "liffey"	0
23/10/2019	13:41	Low	As above but around 60 BH took flight, 4 OC, 10 RK & 13 TT allerted and flew briefly before returning to normal	Heron flyover Study area	2
23/10/2019	13:58	Low	265 BH, 7 HG, 1 MU, 8 GB, 4 OC, 16 TT, 9 RK, 15 CA, 2 H,	Small Craft dublin pilot "liffey"	0

23/10/2019	14:06	L-M rising	261 BH, 18 HG, 1 MU, 4 GB, 1 OC, 9 TT, 5 RK, 13 CA, 1 H, 1 GG	Seatruck Small Wake produced caused a small surge in study area which caused a handfull of RK and TT to alert and walk	1
23/10/2019	14:26	L-M rising	250 BH, 16 HG, 8 GB, 1 OC, 14 TT, 8 RK, 1 H, 17 CA, 2 GG	Ship BGFreight "Andromeda"	0
23/10/2019	14:43	L-M rising	236 BH, 9 HG, 1 MU, 6 GB, 2 OC, 24 TT, 7 RK, 2 H, 12 CA, 1 GG	Ship Irish Ferries "WB Yeats" temporary oery wake surge	1
23/10/2019	14:50	L-M rising	225 BH, 15 HG, 2 MU, 6 GB, 4 OC, 17 TT, 9 RK, 3 H, 14 CA, 1 GG.	"Rosbeg" tug 140m from Quay working and making manoeuvres 2 divers in water, 5 deck crew. winch in operation	0
23/10/2019	15:05	L-M rising	203 BH, 21 HG, 3 MU, 8 GB, 2 OC, 19 TT, 13 RK, 2 H, 16 CA, 2 GG.	Stena Superfast Passenger ferry temporary wake surge	1
23/10/2019	15:10	L-M rising	168 BH, 11 HG, 4 MU, 5 GB, 1 OC, 8 TT, 3 RK, 1 H, 10 CA, 2 GG.	"Rosbeg" tug moved to 250m from Quay working and making manoeuvres 5 deck crew.	0
23/10/2019	15:38	L-M rising	175 BH, 12 HG, 6 GB, 2 OC, 12 TT, 5 RK, 2 H, 14 CA, 1 GG.	"Rosbeg" tug moved to 300m from Quay working and making manoeuvres 5 deck crew.	0
24/10/2019	12:10	M-L falling	325 BH, 23 HG, 2 GB, 5 MU, 2 CM, 1 OC, 25 TT, 2 RK, 1 H, 22 CA, 1 CU	Seatruck Westbound	0
24/10/2019	12:14	M-L falling	325 BH, 23 HG, 2 GB, 5 MU, 2 CM, 1 OC, 25 TT, 2 RK, 1 H, 22 CA, 1 CU	Ship Irish Ferries "Epsilon" Westbound	0
24/10/2019	12:31	M-L falling	325 BH, 23 HG, 2 GB, 5 MU, 2 CM, 1 OC, 25 TT, 2 RK, 1 H, 22 CA, 1 CU	Ship Stenna superfast westbound small wake surge up on beach, 15 TT moved up gull also moved a few metres up	1
24/10/2019	13:18	M-L falling	350 BH, 28 HG, 4 GB, 5 MU, 5 CM, 3 OC, 20 TT, 9 RK, 1 H, 18 CA,	kestrel female flew over vp and flushed approximately 60% of the BH and the waders. Disturbance was temporary and all affected returned to area.	2
24/10/2019	13:28	M-L falling	320 BH, 17 HG, 2 GB, 3 MU, 2 CM, 4 OC, 25 TT, 11 RK, 1 H, 16 CA, 1 GG	Seatruck Eastbound very very slow ahead no noticeable wake or bow wave produced	0
24/10/2019	13:35	M-L falling	320 BH, 17 HG, 2 GB, 3 MU, 2 CM, 4 OC, 25 TT, 11 RK, 1 H, 16 CA, 1 GG	Small Craft Boksalis RIB Eastbound	0
24/10/2019	13:38	M-L falling	340 BH, 24 HG, 2 GB, 3 MU, 2 CM, 4 OC, 25 TT, 11 RK, 1 H, 16 CA, 1 GG	Dredger "Freeway" Westbound 350m from vp	0
24/10/2019	13:52	M-L falling	390 BH, 29 HG, 2 GB, 5 MU, 1 CM, 3 OC, 5 TT, 6 RK, 1 H, 13 CA, 2 GG	Ship BGFreight "Andromeda" Westbound small wake surge in study area	1
24/10/2019	14.02	M-L falling	380 BH, 32 HG, 2 GB, 5 MU, 1 CM, 3 OC, 5 TT, 6 RK, 1 H, 13 CA, 2 GG, 2 CU	Ship Celtic Voyager Eastbound	0
24/10/2019	14:15	M-L falling	370 BH, 34 HG, 2 MU, 2 CM, 2 OC, 23 TT, 12 RK, 16 CA,	Dredger "Freeway" Eastbound 210m from vp Actively dredging	0
24/10/2019	14:30	M-L falling	350 BH, 28 HG, 4 GB, 5 MU, 5 CM, 3 OC, 20 TT, 9 RK, 1 H, 18 CA,	Dredger "Freeway" Westbound 210m from vp in Reverse	0
24/10/2019	14:40	Low	310 BH, 36 HG, 5 GB, 4 MU, 3 CM, 4 OC, 13 TT, 4 RK, 12 CA.	Ship Irish Ferries "WB Yeats" temporary wake surge	1
24/10/2019	14:42	Low	310 BH, 36 HG, 5 GB, 4 MU, 3 CM, 4 OC, 13 TT, 4 RK, 12 CA.	small craft brian boru	0
24/10/2019	14:58	L-M rising	300 BH, 27 HG, 5 GB, 3 MU, 4 CM, 2 OC, 8 TT, 6 RK, 5 CA, 1 CU	Ship Stena superfast westbound small wake surge up on beach, 15 TT moved up gull also moved a few metres up	1

24/10/2019	15:09	L-M rising	300 BH, 27 HG, 5 GB, 3 MU, 4 CM, 2 OC, 8 TT, 6 RK, 5 CA, 1 CU	"Rosbeg" tug 250m from Quay working and making manoeuvres 5 deck crew.	0
24/10/2019	15:16	L-M rising	280 BH, 24 HG, 3 GB, 4 MU, 2 CM, 2 OC, 15 TT, 10 RK, 8 CA, 1 CU, z	Ship "Laureline" container vessel	0
24/10/2019	15:29	L-M rising	255 BH, 17 HG, 2 GB, 2 MU, 1 CM, 1 OC, 7 TT, 6 RK, 5 CA, 1 CU	ship Container "Mistral" Eastbound very small wake into survey area with no affect	0
24/10/2019	15.52	L-M rising	205 BH, 22 HG, 5 GB, 3 MU, 2 CM, 4 OC, 23 TT, 12 RK, 18 CA, 2 CU	Seatruck "Clipperpoint" Eastbound fast ahead large noticeable wake causing localised type 1 disturbance to @ 50 BH, 12 TT, 5 RK and 2 CU	1
24/10/2019	16:05	L-M rising	225 BH, 17 HG, 3 GB, 10 MU, 2 OC, 13 TT, 7 RK, 23 CA, 1 CU, 1 GG	Small Craft dublin pilot "liffey" Westbound	0
24/10/2019	16:23	L-M rising	295 BH, 23 HG, 6 GB, 8 MU, 6 OC, 2 BA, 20 TT, 4 RK, 26 CA, 4 CU, 2 GG	large Ship "Hermine" Westbound very slow no wake	0
24/10/2019	16:40	L-M rising	345 BH, 28 HG, 2 GB, 11 MU, 4 OC, 2 BA, 13 TT, 10 RK, 25 CA, 4 CU 2 CM.	"Rosbeg" tug moved 350m from Quay working and making manoeuvres 5 deck crew.	0
25/10/2019	13:53	M-L falling	1 RK, 3 TT, 3 CA, 17 HG, 1 OC, 412 BH	Pilot boat "Liffey" passing	0
25/10/2019	13:54	M-L falling	1 RK, 3 TT, 1 CU, 4 CA, 24 HG, 1 OC, 412 BH	Dredger "Freeway" passing by survey area	0
25/10/2019	14:03	M-L falling	1 RK, 3 TT, 1 CU, 4 CA, 24 HG, 1 OC, 452 BH, 1MU	Ship "Arklow Cape" passing	0
25/10/2019	14:07	M-L falling	6 RK, 3 TT, 1 CU, 4 CA, 24 HG, 1 OC, 551 BH, 1 MU	Dredger "Freeway" slowly passing survey area until 14:17	0
25/10/2019	15:32	Low	1 OC. 10 TT, 5 BW, 3 CA, 4 SS, 3 RK, 1 H., 39 HG, 551 BH	Ship "Mistral" passing	0
25/10/2019	15:50	Low	1 OC. 10 TT, 5 BW, 3 CA, 4 SS, 3 RK, 1 H., 39 HG, 551 BH	Ship "Hermine" passing	0
25/10/2019	16:26	L-M rising	1 OC. 10 TT, 5 BW, 3 CA, 4 SS, 3 RK, 1 H., 39 HG, 551 BH	Pilot boat "Liffey" passing	0
25/10/2019	16:49	L-M rising	c.400 BH, 4 MA, 3 TT, 3 HG	Seatruck "Power" passing	0
25/10/2019	16:57	L-M rising	c.400 BH, 4 MA, 3 TT, 3 HG	Stena "Adventurer" passing	0
25/10/2019	17:05	L-M rising	c.400 BH, 4 MA, 3 TT, 3 HG	P&O "Norbank" passing	0
25/10/2019	17:10	L-M rising	c.400 BH, 4 MA, 3 TT, 3 HG	Irish Ferries "Ulysses" passing	0
25/10/2019	17:19	L-M rising	c.400 BH, 4 MA, 3 TT, 3 HG	Work boat "Rosbeg" passing	0
26/10/2019	14:10	M-L falling	8 TT, 3 CA, 1 OC, 5 HG, 376 BH	Small pleasure craft passing inside of bouy	0
26/10/2019	14:37	M-L falling	18 SS, 4 CA, 9 HG, 1 CU, 360 BH	Pilot boat "Liffey" passing	0
26/10/2019	14:42	M-L falling	18 SS, 4 CA, 9 HG, 1 CU, 360 BH	Small pleasure craft passing inside of bouy	0
26/10/2019	15:00	M-L falling	18 SS, 4 CA, 9 HG, 1 CU, 360 BH	Stena Superfast X	0
26/10/2019	15:22	M-L falling	2 RK, 17 HG, 1 CA, 300 BH	Irish Ferrires "WB Yeats" departing, very slowly. Almost appeared to have stopped off survey area.	0

26/10/2019	15:36	M-L falling	2 RK, 17 HG, 1 CA, 300 BH	Tanker "Sten Nordic" and ship "Peregrine" passing	0
26/10/2019	15:58	M-L falling	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Boskalis survey boat "Smit Leyland" passing	0
26/10/2019	16:10	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Boskalis survey boat "Smit Leyland" passing	0
26/10/2019	16:14	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Pilot boat "Liffey" passing	0
26/10/2019	16:16	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Boskalis survey boat "Smit Leyland" passing back and forth by survey area until 16:25	0
26/10/2019	16:30	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Boskalis survey boat "Smit Leyland" passing	0
26/10/2019	16:37	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Tanker "Thun Genius" passing	0
26/10/2019	16:39	Low	56 HG, 12 SS, 1 CA, 450 BH, 2 RK, 1 OC, 2 BW	Irish Ferries "Epsilon"	0
26/10/2019	17:09	L-M rising	72 HG, 18 SS, 3 CA, 300 BH, 2 RK, 1 OC, 2 BW	Small pleasure craft passing	0
26/10/2019	17:11	L-M rising	72 HG, 18 SS, 3 CA, 300 BH, 2 RK, 1 OC, 2 BW	Norbank	0
26/10/2019	17:16	L-M rising	72 HG, 18 SS, 3 CA, 300 BH, 2 RK, 1 OC, 2 BW	Stena Adventurer	0
26/10/2019	17:23	L-M rising	72 HG, 18 SS, 3 CA, 300 BH, 2 RK, 1 OC, 2 BW	Seatruck "Power" passing	0
26/10/2019	17:29	L-M rising	72 HG, 18 SS, 3 CA, 300 BH, 2 RK, 1 OC, 2 BW	Irish Ferries "Ulysses" passing	0
27/10/2019	14:25	M-L falling	380 BH, 20 HG, 10 GB, 3 MU, 1 OC, 2 BA, 20 TT, 10 RK, 13 CA, 2 CU 8 CM, 4 GG,	small craft 2 men onboard fishing?	0
27/10/2019	14:39	M-L falling	380 BH, 20 HG, 10 GB, 3 MU, 1 OC, 2 BA, 20 TT, 10 RK, 13 CA, 2 CU 8 CM, 4 GG,	Ship Irish Ferries "WB Yeats" heading out Eastbound, temporary wake surge	1
27/10/2019	14:56	M-L falling	400 BH, 20 HG, 10 GB, 9 MU, 4 OC, 8 BA, 20 TT, 10 RK, 20 CA, 6 CU 8 CM, 4 GG,	Small yacht "Bona" Eastbound	0
27/10/2019	15:00	M-L falling	400 BH, 20 HG, 10 GB, 9 MU, 4 OC, 8 BA, 20 TT, 10 RK, 20 CA, 6 CU 8 CM, 4 GG,	Stena Superfast Passenger ferry eastbound wake into survey area temporary disturbance	1
27/10/2019	15.03	M-L falling	430 BH, 20 HG, 10 GB, 9 MU, 16 OC, 18 BA, 30 TT, 15 RK, 20 CA, 7 CU 9 CM, 4 GG, 5 MA,	Dublin Port Authority Pilot Eastbound fast small wake	0
27/10/2019	15.22	M-L falling	450 BH, 80 HG, 16 GB, 7 MU, 16 OC, 18 BA, 30 TT, 15 RK, 20 CA, 12 CU 9 CM, 6 GG, 5 MA,	Ship Freighter "Bit Ecco" Eastbound small wake very slow	0
27/10/2019	15:33	M-L falling	450 BH, 110 HG, 19 GB, 5 MU, 18 OC, 10 BA, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA,	Ship Freighter "MISTRAL" Eastbound small wake	1
27/10/2019	15:51	M-L falling	500 BH, 110 HG, 19 GB, 5 MU, 18 OC, 10 BA, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA, 1 H, 23 SS	small Yacht Westbound very slow no significant wake	0
27/10/2019	15:53	M-L falling	500 BH, 110 HG, 19 GB, 5 MU, 18 OC, 10 BA, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA, 1 H, 45 SS,	Small Craft Boksalis RIB Westbound no significant wake	0
27/10/2019	15:58	M-L falling	500 BH, 110 HG, 19 GB, 5 MU, 18 OC, 18 BA, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA, 2 H, 85 SS	Dublin Port Authority Pilot Westbound fast small wake	0

27/10/2019	16:12	Low	500 BH, 110 HG, 15 GB, 5 MU, 18 OC, 18 BA, 10 BW, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA, 2 H, 65 SS, 30 DN,	Ship Freighter Matthew LPG slow Westbound small wake no significant disturbance	0
27/10/2019	16:15	Low	500 BH, 110 HG, 12 GB, 5 MU, 18 OC, 10 BA, 20 TT, 15 RK, 24 CA, 12 CU 9 CM, 2 GG, 5 MA, 2 H, 50 SS	Small yacht "Celtic Mist IWDG" Westbound	0
27/10/2019	16:40	L-M rising	600 BH, 160 HG, 54 GB, 8 MU, 25 OC, 15 BA, 10 BW, 10 TT, 10 RK, 20 CA, 17 CU 15 CM, 7 GG, 3 H, 50 SS, 30 DN	Dublin Port Authority Pilot Eastbound fast wake flushed approximately 40 SS and 20 DN which as a result flew northwest towards esturine mud south of the Bull wall	3
27/10/2019	17.01	L-M rising	600 BH, 160 HG, 54 GB, 8 MU, 25 OC, 15 BA, 10 BW, 10 TT, 10 RK, 20 CA, 17 CU 15 CM, 7 GG, 3 H, 50 SS, 30 DN	Stena Adventurer passenger ferry Westbound very slow small wake no percieved disturbance.	0
27/10/2019	17:13	L-M rising	600 BH, 190 HG, 50 GB, 8 MU, 30 OC, 15 BA, 10 BW, 10 TT, 10 RK, 20 CA, 12 CU 15 CM, 5 GG, 5 H, 35 SS, 20 DN	Irish Ferries "Ulysses" Westbound slow minimal wake onto survey area.	0
27/10/2019	17:22	L-M rising	520 BH, 130 HG, 40 GB, 6 MU, 13 OC, 8 RK, 26 CA, 6 CU 10 CM, 2 GG, 4 H, 13 SS, 20 DN, 2 TY	Dublin Port Authority Pilot Westbound very fast produced that wake flushed rest of 13 SS & 20 DN which as a result flew northwest towards esturine mud south of the Bull wall	3
27/10/2019	17:28	L-M rising	520 BH, 130 HG, 40 GB, 6 MU, 13 OC, 8 RK, 26 CA, 6 CU 10 CM, 2 GG, 4 H,	Container Freighter ""BG JADE" westbound slow no significant wake	0
27/10/2019	17:44	L-M rising	520 BH, 130 HG, 40 GB, 6 MU, 13 OC, 8 RK, 26 CA, 6 CU 10 CM, 2 GG, 4 H,	Container Freighter "ELB FEEDER" westbound slow	0